Florida Multifamily Efficiency Opportunities Study

Prepared for:
Florida Department of Agriculture and Consumer Services - Office of Energy

Prepared by:
University of Florida - Public Utility Research Center
University of Florida - Program for Resource Efficient Communities
University of Central Florida - Florida Solar Energy Center

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Disclaimer

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Prepared for:

Florida Department of Agriculture and Consumer Services (FDACS)
Office of Energy
600 S. Calhoun St.
Tallahassee, FL 32239-1300

Prepared by:

Lynne Holt, Ph.D.
Mark Jamison, Ph.D.
Theodore Kury, Ph.D.
Michelle Phillips, Ph.D.
University of Florida's Public Utility Research Center (PURC)

Lynn Jarrett
Pierce Jones, Ph.D.
Craig Miller
Jennison Kipp Searcy
Nicholas Taylor
University of Florida's Program for Resource Efficient Communities (PREC)

David Chasar
Jeremy Nelson
Jeffrey Sonne
Robin Vieira
University of Central Florida's Florida Solar Energy Center (FSEC)

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Finally, we appreciate the funding of the Florida State Energy Office that made this study possible.

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List of Acronyms and Key Terms

ACEEE—American Council for an Energy-Efficient Economy

ACS—United States Census Bureau American Community Survey

AFUE—Annual Fuel Utilization Efficiency

AMI—Advanced Metering Infrastructure

ARRA—American Recovery and Reinvestment Act

ASHRAE—American Society of Heating, Refrigerating, and Air-Conditioning Engineers

AWE—Alliance for Water Efficiency

Benchmarking—A method of comparing the efficiency performance, in this context energy or water, of a given property to that of other similar properties.

BTU—British Thermal Unit

"Carrots"—Positive incentives. This term is part of the "carrot-and-stick" approach to influence behavior.

CBSM—Community-Based Social Marketing

CFEEA—Central Florida Energy Efficiency Alliance

CNT—Center for Neighborhood Technology

Cost-burdened—Households that pay more than 30% of their gross income for rent and utilities.

"Deep" retrofits—Installation of a comprehensive package of energy- and/or water-efficiency measures. These measures address the whole building system, including high-efficiency heating, ventilation and air conditioning systems, duct sealing, attic and wall insulation, building envelope tightness, lighting, major appliances and fixtures, controlled ventilation, etc. to realize significant savings.

DC SEU—District of Columbia Sustainable Energy Utility

DEO—Department of Economic Opportunity

DEP—Department of Environmental Protection

DOE—U.S. Department of Energy

DSIRE—Database of State Incentives for Renewable Energy

ECCR—Energy Cost Recovery Clause

EF—Energy Factor

ENERGY STAR®—A United States Environmental Protection Agency program that designates certain appliances, buildings, and electronics as meeting specific energy-efficiency standards.

EPA—United States Environmental Protection Agency

ESCO—Energy Service Companies

EUA—Energy Usage Analyses

FAA—Florida Apartment Association

FAWCET—Florida Automated Water Conservation and Evaluation Tool

FBGC—Florida Green Building Coalition

FDACS—Florida Department of Agriculture and Consumer Services

FEECA—Florida Energy Efficiency and Conservation Act

FEEL—Florida Energy Efficiency Loan program

Florida Water Star^{SM}—A Florida Program that certifies particular fixtures and landscapes use less water than code efficiency standards.

FPSC—Florida Public Service Commission

Free drivers—Customers who are not participating in a program and are motivated to invest in efficiency measures as a result of observing program participants.

Free riders—Customers participate in a program and receive program incentives even though they would have made the same efficiency upgrades in the absence of the program.

FSEC—The Florida Solar Energy Center, an energy research institute at the University of Central Florida.

GWh—Gigawatt Hour

HERS—Home Energy Rating System

HSPF—Heating System Performance Factor

HUD—United States Department of Housing and Urban Development

HVAC—Heating, Ventilation, and Air Conditioning

ICC—International Construction Code

IECC—International Energy Conservation Code

IMT—Institute for Market Transformation

IPC—International Plumbing Code

kWh—Kilowatt hours

LEAN—Low-Income Energy Affordability Network

LIHEAP—Low-Income Home Energy Assistance Program

LIHTC—Low-Income Housing Tax Credit

MA EEAC—Massachusetts Energy Efficiency Advisory Committee

MERP—Multifamily Energy Retrofit Program

MGD—Million gallons per day

MOU—Memorandum of Understanding

Multifamily—Properties or buildings with two or more residential dwelling units.

NHT—National Housing Trust

NPV—Net Present Value

NRDC—Natural Resources Defense Council

NYSERDA—New York State Energy Research and Development Authority

Opportunity cost—The benefits that could be realized if the best alternative action is taken.

PACE –Property Assessed Clean Energy

PREC—The Program for Resource Efficient Communities is a research and outreach unit at the University of Florida that promotes the adoption of best design, construction and management practices to measurably reduce energy and water consumption and environmental degradation in residential communities.

PSE&G—Public Service Electric and Gas

PUMS—Public Use Microdata Sample

PURC—The Public Utility Research Center at the University of Florida is an internationally recognized academic center dedicated to research and to providing training in utility regulation and strategy, as well as the development of leadership in infrastructure policy.

Rebound effect—In the context of this report, savings that would be realized from improved building, technical or equipment efficiency are partially or entirely offset by changes in consumer behavior such as turning up the heat in the winter.

RECO—Residential Energy Conservation Ordinance

RECS—Residential Energy Consumption Survey

Retrofits—Improvements to base energy or water efficiency in existing buildings (in the context of this report, multifamily buildings).

RIM—Rate Impact Measure

RPS—Renewable Portfolio Standards

SAHF—Stewards of Affordable Housing for the Future

SCT—Societal Cost Test

SEER—Seasonal Energy Efficiency Ratio

'Shallow" or "rapid-return" retrofits—The installation of energy- or water-efficiency measures with a short payback period.

SHGC—Solar Heat Gain Coefficient is the fraction of solar energy that crosses through windows. Lower numbers indicate less heat enters the building.

SIR—Savings to Investment Rations

SJHP—St. Johns Housing Partnership

SJRWMD—St. Johns River Water Management District

SMUD—Sacramento Municipal Utility District

Split incentive—In the context of this report, the challenge that arises when property owners (landlords) who are responsible for decisions to invest in efficiency measures lack incentives to do so because the payoff from that investment is likely or expected to accrue to tenants and not to them.

"Sticks"—Disincentives or sanctions. This term is part of the "carrot and stick" approach to influence behavior.

TDV—Time Dependent Valuation

Throughput incentive—Under traditional regulation, utilities are discouraged from investing in improved efficiency because such investments reduce their revenues. They are encouraged to sell more energy.

TRC—Total Resource Cost

UCT—Utility Cost Test

UPC—International Association of Plumbing and Mechanical Officials' Uniform Plumbing Code

Executive Summary

Study motivation

The goal of this study is to identify opportunities to improve the energy and water efficiency of Florida's multifamily rental properties. Because the bulk of savings potential in the multifamily building stock is in existing properties and because low-income households tend to bear a disproportionate share of the cost burdens associated with rental property inefficiencies, the focus is on identifying policy, program and code incentives to encourage Florida's multifamily property owners to invest in energy-and water-efficiency retrofit activities.

Overview: The Florida market for energy and water efficiency in multifamily dwellings is ripe with potential, offering the promise of substantial returns on investment in retrofit activities. Yet the multifamily efficiency market is inherently complex, with variability in savings potential across different property types and a wide diversity of stakeholders who need to be engaged. Furthermore, decision makers operating in the multifamily rental market often have competing or conflicting incentives to participate (invest) in retrofit activities. Because of this market complexity, significant challenges arise that hinder progress in capturing the potential benefits of efficiency retrofits to Florida's multifamily properties. Despite these challenges, there has been a surge of activity in multifamily efficiency retrofits and a growing body of evidence that investments are likely to pay off for property owners (landlords) and tenants alike.

The Circular Dilemma: The most pervasive and vexing barrier to stimulating retrofit activity in rental housing is the so-called "split incentive" problem, whereby the property owners who are responsible for making efficiency investments have little incentive to do so, and the tenants who bear the direct costs of inefficiencies (high utility bills) have limited opportunity and/or authority to make retrofit decisions. A rental property owner will only come to the table to consider an efficiency retrofit opportunity when that owner has some degree of confidence that the investment decision will pay off: that the efficiency opportunity promises greater returns on investment than do alternative investment options.

A landlord's perceived return on efficiency investments is typically low relative to other opportunities because of her expectation that the stream of benefits will flow to tenants rather than back into her own financial portfolios. Except in cases where retrofit activities are heavily subsidized or owners are driven by a mission that embraces conservation and efficiency, this common perception translates to no or few on-the-ground multifamily efficiency retrofit projects.

It is not possible to understand, quantify and communicate the full benefits and costs of potential efficiency investments without good tracking and analytic data. Until we can generate and leverage the data to build the case for efficiency retrofits and sell investment opportunities to property owners and landlords, the market will remain stagnant. If the retrofit market is stagnant or sluggish, few opportunities exist to generate the data needed to build the case for property owners to invest in efficiency. Furthermore, the market for multifamily efficiency retrofits is occupied by many different stakeholders who have diverse and often conflicting incentive structures.

Challenges:

- *The "split-incentive" problem*: it is very difficult to bring landlords/multifamily property owners to the table to consider the efficiency retrofits to their properties when tenants pay the utility bill.

- *Uncertain returns on retrofit investments*: there are few studies on the measured effectiveness of energy and water retrofits to multifamily properties in Florida, so the potential savings and costs are difficult to quantify with certainty.
- *Unique opportunities if diagnosed*: existing multifamily housing may be conditioned with central or separate units for space conditioning or water heating or ventilation. The most cost-effective improvements may require diagnosis by experienced building scientists.
- *Financing gaps and constraints*: while potential investors and financial institutions are coming to the table and infusing capital to this market (providing low-cost loans and up-front capital to support retrofit projects), emerging programs to connect these investors to property owners and to spur the retrofit activity are making slow progress.
- *Information gaps:* it is evident that additional education and awareness, provision of information, coordination of resources, and provision of additional incentives (carrots and/or sticks) are necessary to speed activity in this space.
- *Room to raise the bar*: where mandatory provisions for multifamily efficiency are in place, there are gaps that need to be addressed to ensure that these provisions translate to efficiency gains. There is a general consensus that much progress could be made in Florida by improving the implementation and enforcement of existing building codes, permitting and licensing rules.

Opportunities: The market for multifamily efficiency in Florida has become very active in recent years largely as a result of efforts by national efficiency and affordable housing advocacy groups, and grassroots initiatives coupled with infusion of stimulus funds. These efforts have led to a sizeable number of multifamily efficiency pilot projects, programs and initiatives in Florida, all of which provide preliminary results, lessons learned and tools that can guide next steps in multifamily efficiency policies, programs and projects and thereby inform stakeholder decision making.

Most efficiency programs and incentives are—by design and/or by market conditions—effective in reaching single-family households and other owner-occupied buildings. Policies and programs to improve the efficiency of multifamily rental properties address a market segment that has historically not been well represented but that can potentially capture substantial and scalable energy and water savings.

Many efficiency measures and best practices appropriate for inclusion in multifamily retrofit packages are cost-effective “low-hanging fruit”, which means that payback periods are expected to be relatively short (five years or less) for most retrofit projects. The cost effectiveness of retrofits can be improved even further through use of targeting and time-of-transaction strategies/best practices. These strategies leverage utility consumption data and other publicly available information to identify the properties, buildings, units and/or property owners most likely to benefit from retrofit investments and target incentives and tools to coincide with key decision points by property owners or governing authorities.

Study goal and scope

The goal of this study is to collect and synthesize information from existing literature, industry stakeholders and thought leaders. This information is then used to identify the most promising options for Florida to provide incentives to landlords for retrofitting their multifamily properties, thereby saving energy and water and reducing the utility cost burdens on tenants. The multifamily efficiency study involved two phases: (1) information collection and (2) formulation of recommendations. The project team includes personnel from the University of Florida (UF) Public Utility Research Center (PURC) who focused on policy analysis, the UF

Program for Resource Efficient Communities (PREC) who focused on program analysis, and the University of Central Florida's (UCF) Florida Solar Energy Center (FSEC), who focused on analysis of codes and modeled savings potential.

The first objective of the study was to document the potential amount of energy and water savings that could be achieved from improvements to Florida's multifamily rental housing and methods of capturing these potential savings. This documentation involved characterization of Florida's multifamily housing stock and collection of information on current policies, codes, programs, and measures to improve the energy and water efficiency of multifamily housing stock. The Project Team synthesized and evaluated this information to:

assess the scale of savings potential (energy and water) from retrofits to Florida's multifamily rental properties;

1. identify existing policies, codes and programs in Florida and other states that target the market for efficiency in multifamily rental properties; and
2. identify specific initiatives, stakeholders and strategies that have been successful in providing incentives to landlords to improve the efficiency of their multifamily properties and that are applicable to Florida's multifamily rental buildings and property owners.

The second objective of the study was to identify substantive policy options and programs that Florida may consider adopting and implementing to encourage landlords to make needed improvements. Phase 2 involved synthesis and integrated evaluation of the information collected in Phase 1 to assess the suitability of various policy and program options for tackling the split incentive problem. Results of the team's assessment were used to formulate: 1) a list and explanation of best practices and considerations for Florida's multifamily efficiency initiatives, and 2) a list of recommended policies, building code changes and programs that Florida could potentially adopt to improve energy and water efficiency in the state's multifamily rental housing.

To expedite and guide formulation of recommendations through the course of the study, the work plan involved an explicit stakeholder engagement component. The Project Team used semi-structured phone interviews to gather feedback and insights specific to Florida and multifamily efficiency best practices from key industry stakeholders (e.g., property owners and managers, apartment associations, utility representatives) and from multifamily efficiency policy and program leaders (e.g., advocacy groups and nonprofits, housing finance agencies and local governments).

Key findings and recommendations

Burdens of inefficiency: The majority of Florida's renter households have low incomes and face high housing cost burdens, with trends showing that housing costs are consuming an increasing share of low-income families' take-home pay. About one million rental households in the state are considered to be low income, defined as those who make no more than 60% of the area's median income. Of these households, about 71% paid more than 40% of their total income in housing expenses (rent plus utilities) in 2011. This represents a 60% increase over the number of similarly cost-burdened households in the year 2000.[1] A portion of these low-income renter households (238,000) live in assisted and public housing units, more

[1] Shimberg Center for Housing Studies, University of Florida for the Florida Housing Finance Corporation, 2013 Rental Market Study: Affordable Housing Needs, page 6. http://www.shimberg.ufl.edu/publications/Full_RMS_Needs.pdf

than three quarters of which (183,000) are multifamily rental units.[2] Efficiency retrofits are an important strategy to reduce utility bills and ease housing cost burdens.

Typical Florida multifamily rental units: Florida's multifamily rental housing can be characterized by the following important statistics and features:

- Over half of all units were built prior to 1980 when the first energy codes came into effect in Florida (1983 for water efficiency codes), so are less efficient than most other types of housing.
- One- and two-bedroom apartments make up 90% of the units, in approximately equal numbers, with an average size of almost 900 square feet.
- Almost all units have full kitchens and a single bathroom.
- Electricity consumption is more than 800kWh per month, costing about $100 monthly.
- Cooling and hot water consume the most electricity, followed by equal amounts for lighting, appliances, and miscellaneous (including electronics). Heating requires only four percent of the power consumed, on average.
- Average indoor water use is much higher in older units (more than 5,000 gallons per month) compared to just over 2,000 gallons used per month in newer units.
- Toilets, faucets, and showers all use between 25%–30% of water in older apartments. Clothes washers use about 15% and leakage accounts for approximately 7% in these units.

Unit-level energy and water savings potential: The potential energy and water savings from efficiency retrofits to "typical" Florida multifamily rental units were modeled under "shallow" and "deep" retrofit package scenarios. The energy model evaluated impacts of retrofits to typical top-floor and middle units in Miami, Tampa, and Jacksonville. The water model estimated indoor savings from efficiency improvements to typical (two-bedroom) units across three "year built" categories: pre-1983, 1983-1994, and 1995-2013. These time periods correspond with Florida's major plumbing code changes and are good indicators of the base water efficiency of exiting toilets, showerheads, faucets and washing machines as well as leakage rates.

Modeling results indicate that shallow energy retrofits to a typical two-bedroom apartment in Tampa (993 square feet in size) would generate annual electricity savings of 1,533 kWh (14% of base use and $184 in energy bill savings). Deep energy retrofits would produce annual savings of 3,382 kWh per unit (31% of base use and $406 in bill savings). Shallow water retrofits to each typical Florida multifamily unit constructed prior to 1983 would save 34,624 gallons per year (57% of base use and $346 in avoided water and wastewater bills) and deep retrofits would save 40,020 gallons per year (66% of base use and $400 in avoided water and wastewater bills).

Scaled savings potential: Based on modeled per-unit energy and water savings potential and depending on the age of the units and level of retrofit, a 10,000 unit efficiency retrofit project could yield total annual savings of between $2.1 million and $8.1 million. If scaled to reach the state's 1.3 million existing multifamily rental units, combined energy and water improvements could lead to annual energy savings of 3,286 GWh—enough to provide electricity to over 300,000 Florida homes for one year[3]—and water savings of 87.7 million

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[2] Queries for Florida housing statistics used in this study were generously provided to the study team by Anne Ray at the University of Florida, Shimberg Center for Housing Studies. Information about and data from the Florida Housing Data Clearinghouse are accessible at http://flhousingdata.shimberg.ufl.edu/about.html

[3] Based on conversion using the U.S. EPA's Greenhouse Gas Equivalency Calculator, http://www.epa.gov/cleanenergy/energy-resources/calculator.html. Accessed January 2015.

gallons per day (MGD)—enough to fill over 48,000 Olympic-sized swimming pools. This scenario assumes shallow retrofits to newer units (those built since 1983) and deep retrofits to older units (those built prior to 1983). Efficiency improvements of this scale could save Florida's multifamily property owners and renters an estimated $714 million in annual utility bills.

Multifamily efficiency best practices: To address market challenges like the split incentive problem and capture energy and water savings in Florida's multifamily housing stock, multifamily efficiency programs must be integrated and comprehensive in design strategies, implementation frameworks and enforcement/follow-through provisions. Multifamily efficiency programs for Florida should adopt a suite of best practices including but not limited to:

- Strategically targeting subsets of the multifamily housing market;
- Structuring incentives to encourage whole-building retrofits;
- Calibrating incentives to performance outcomes;
- Coordinating energy and water efficiency measures to the greatest extent possible;
- Establishing alternative financing options and flexible pathways; and
- Showcasing successful Florida programs to serve as models for new and long-term multifamily initiatives.

Recommendations: Our recommendations detail eight policies and programs that Florida could adopt and implement to offer incentives for improved efficiency and retrofits to multifamily buildings:

1. Implement a pilot program/demonstration project that tests **innovative code enforcement mechanisms**. The intent of such a program or project would be to strengthen the impact of existing code provisions for energy and water efficiency.

2. Implement a **time-of-transaction** efficiency (TOTE) or **point-of-sale** efficiency (POSE) pilot program/demonstration project. Such a program should be designed to reach multifamily properties with retrofit opportunities that coincide with key property maintenance/transfer and landlord decision-making processes.

3. Implement a pilot program/demonstration project that uses **market-driven tools to publicize and market housing costs** in terms of average rents plus average utility costs. That information can be used to inform owner, renter, and third-party decisions about retrofit opportunities and efficiency investments.

4. Create a **one-stop shop** (statewide and/or local, community-based) for multifamily efficiency retrofit resources, tools, programs and partners. A multifamily efficiency "one-stop shop" would streamline the process of planning, implementing, financing and ensuring the quality of an efficiency retrofit investment.

5. Implement a pilot program/demonstration project that **targets efficiency retrofit measures to specific multifamily market segments** (using benchmarking best practices). Such a program or project would benchmark current energy and water efficiency/performance and target specific owners, properties, buildings, and/or units with retrofit opportunities to capture deep, cost-effective and scalable savings.

6. Develop and deliver **new education and awareness programs** tailored to the needs of multifamily property owners, managers, maintenance staff, and tenants. Such programs would leverage existing

continuing education infrastructure and resources while expanding their reach and content to explicitly include multifamily energy and water efficiency.

7. Provide funding for pilot programs that **include as part of walk-through audits the installation of efficiency measures with short payback periods** (i.e., "shallow" measures or "rapid-return" retrofit packages).

8. **Develop and pilot test an on-bill financing program** to increase access to financing in support of retrofit activities/investments. To increase program success, provide funding to utility partners so that they can couple rebates with low-interest revolving loan funds incentives for property owners.

Organization of report

The body of the report is organized as follows:

Section 1 (Introduction) provides relevant context for the study and a framework for evaluating multifamily efficiency opportunities. This section discusses stakeholders' incentives/disincentives for pursuing energy and water efficiency; details common opportunities and challenges in the market for multifamily efficiency investments; and outlines a broad framework for evaluating strategies to increase efficiency retrofit activity in Florida's multifamily rental market.

Section 2 (Savings Potential) estimates Florida's multifamily energy and water savings potential by characterizing the multifamily rental housing stock units (in terms of both property/building/apartment and household/tenant attributes), detailing the parameters of efficiency retrofit packages most suitable for typical multifamily units, and modeling savings for typical units for "shallow" and "deep" retrofit package scenarios.

Section 3 (Efficiency Program Cost Effectiveness) discusses the cost-effectiveness of various energy and water efficiency interventions, citing studies of relevance for developing recommendations specific to Florida's multifamily housing stock.

Section 4 (Existing Multifamily Policies, Programs and Codes) provides an in-depth discussion and listing of existing multifamily efficiency policies and programs in Florida and of successful policies and programs in other states. Building and housing codes that may create incentives for property owners to invest in the efficiency of their rental housing are also detailed in this section.

Section 5 (Multifamily Efficiency Best Practices) summarizes best practices for Florida's multifamily efficiency programs, synthesizing best-practice recommendations from national housing, energy and water research and advocacy groups. The best practices detailed in this section provide a locally-relevant context for the recommendations that follow given considerations unique to Florida's regulatory policy environment, program resources, multifamily housing stock, and savings potentials.

Section 6 (Recommendations) lists and discusses the Project Team's recommendations for multifamily energy and water efficiency policies and programs that Florida could consider developing, adopting and/or incentivizing. The list of recommendations includes both specific, near-term ("rapid-launch") and broader, long-term programs and strategies that have potential energy and water savings and attendant benefits. This section also discusses potential synergies between proposed initiatives and existing gaps in resources necessary to implement policies and programs in a cost-effective and successful manner.

Section 7 (Further Resources) provides a list of references cited in this report and contact information for members of the study team.

1. Introduction

Multifamily housing accounts for a significant share of energy and water consumption and represents an important segment of the market for efficiency retrofits, yet one that is difficult to penetrate and capture at scale. An independent evaluation of the Florida Energy Efficiency and Conservation Act (FEECA) conducted in 2012 identified that multifamily housing had the greatest need for improvements in energy and water conservation. Specifically, the report stated:

"…Florida's Landlord/Tenant Law outlines the responsibilities of the landlord and tenant for complying with applicable building, housing and health codes for maintaining the health and safety of the structure and its occupants. The lack of housing codes standards, and the lack of financial incentives, results in relatively low levels of energy efficiency in older, tenant-occupied structures."[4]

In entering into an agreement with Freddie Mac to improve multifamily efficiency, the U.S. Environmental Protection Agency (EPA) observed that about one third of Americans live in rental or multifamily buildings and that they spend $22 billion on energy each year.[5] Moreover, EPA studies show that energy and water efficiency investments in rental and multifamily properties can improve efficiency by 30 percent, would save $9 billion annually, and would cut 35 million metric tons of greenhouse gas emissions a year.[6] Figure 1-1 is from the American Council for an Energy-Efficient Economy (ACEEE).[7] The grey shading indicates metropolitan areas with a high percentage of multifamily housing and no utility-sponsored multifamily efficiency programs. As can be seen, Florida has four large areas and two smaller areas with a high percentage of rental or multi-tenant dwellings and no multifamily efficiency programs. Furthermore, most multifamily households are occupied by low and medium income renters. According to the United States Department of Housing and Urban Development (HUD),[8] this means that in the United States, the burden of untapped energy efficiency savings is currently "being borne by the families with the fewest resources."

"Most multifamily households are occupied by low and medium income renters. According to the United States Department of Housing and Urban Development (HUD), this means that in the United States, the burden of untapped energy efficiency savings is currently "being borne by the families with the fewest resources."

4 Galligan, Mary, et. al. (2012) "Evaluation of Florida's Energy Efficiency and Conservation Act."

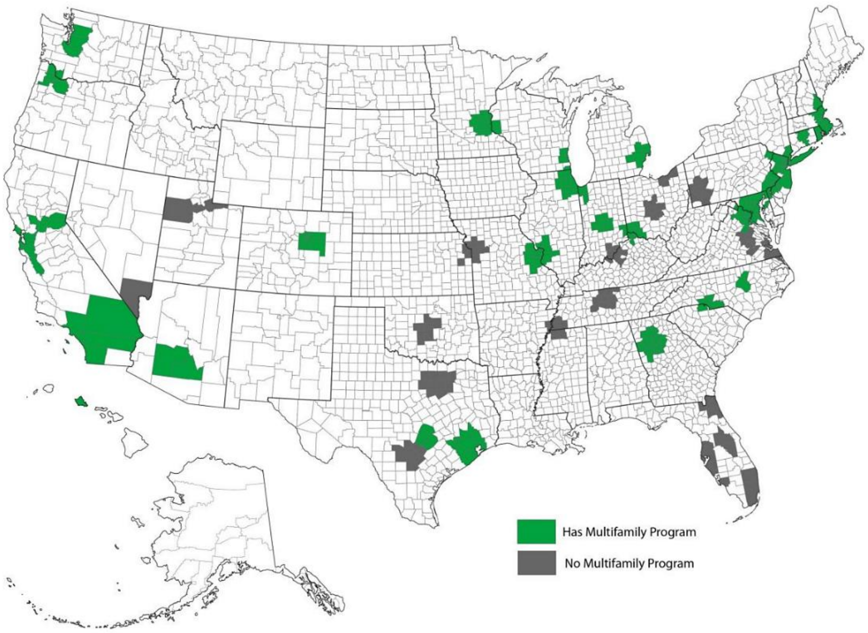
5 "EPA and Freddie Mac to Cut Carbon Pollution and Increase Affordability of Multifamily Buildings", EPA News Release 1/30/2014, http://yosemite.epa.gov/opa/admpress.nsf/0/d4ab4ebb7ac1300d85257c700051d0cc?OpenDocument

6 *Ibid.*

7 Johnson, Kate and Eric Mackres (2013) "Scaling Up Multifamily Energy Efficiency Programs: A Metropolitan Area Assessment", ACEEE Research Report E135, Figure ES-1.

8 U.S. Department of Housing and Urban Development. "Evidence Matters.". Summer 2011.

Figure 1-1 U.S. metropolitan areas with one or more utility-sponsored multifamily efficiency programs (Source: Johnson and Mackres, 2013).[9]



The recent focus on the potential for efficiency improvements has elicited interest in strategies that can address the challenges associated with multifamily efficiency programs and can capture anticipated benefits. Improving Florida's multifamily rental properties requires an inventory of existing policies and programs to stimulate such investments, identification and understanding of initiatives that are working, and assessment of specific policies and programs likely to succeed in Florida given the state's unique features, opportunities and constraints.

> *"Florida's urban centers are dense in multifamily housing but are underserved by utility-sponsored multifamily efficiency programs.*

1.1 Stakeholders

The role of stakeholders is central to the process of improving efficiency and capturing energy and water savings. Stakeholders promulgate and implement policy and decide the types of investments to make. The efficacy of any policy, therefore, depends on how many different types of stakeholders receive and respond to the policy incentives (carrots) and disincentives (sticks). To identify the most promising multifamily efficiency policy and program options for Florida and key decision points around which to coordinate timing of efficiency interventions, one should understand the key stakeholders operating in and affected by such policies and programs and their respective roles. This subsection discusses five main stakeholder groups in the market for multifamily energy and water efficiency: 1) property owners, 2) consumers (tenants), 3) utilities, 4) utility regulators, and 5) state, county and city governments.

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9 Johnson, Kate and Eric Mackres (2013) "Scaling Up Multifamily Energy Efficiency Programs: A Metropolitan Area Assessment", ACEEE Research Report E135, Figure ES-1.

1.1.1 Property owners

The first stakeholder in the multifamily efficiency process is the property owner, who has legally enforced control over the condition of the infrastructure. The property owner may have a number of roles in the energy efficiency process, as the owner may also be a consumer. The incentives for a property owner to invest in efficiency will depend on a number of factors. Two of the most important are: 1) whether the property is privately owned, publicly owned, or privately owned with public support and 2) whether the property owner has included utility costs in the tenant's rent, essentially fixing them from the customer perspective.

Private owners who do not live in the building and are either not responsible for paying the utility bills or can easily pass utility costs along to tenants in rental charges have little incentive to make efficiency investments, as they are not likely to capture utility bill savings and other benefits of the efficiency investment. In the energy-efficiency literature, this situation, commonly referred to as the 'split incentive' problem, presents challenges for both energy and water efficiency programs targeted at multifamily rental properties.

The split incentive problem may be mitigated to some degree if the owner pays the utility bill, but the owner still has no control over the behavior of the tenant. The lack of a price signal to tenants makes it very difficult to promote conservation and efficiency behavior. Non-resident private owners may be motivated to make efficiency investments if they want to elevate the market value of their properties by branding apartments as 'greener' than those of competitors, or by reducing the costs associated with tenant turnover. Tenants may be less inclined to leave apartments that are more water and energy efficient.

A private owner of a building that receives public support may be encouraged to invest in efficiency improvements. For example, participants in the government's Green Preservation Plus initiative have an incentive to improve the efficiency of their building through extra loan proceeds if they commit to making efficiency improvements equal to at least 5% of the mortgage loan amount.[10] Finally, a government owner who is also responsible (either directly or through another subsidy) for the utility bill has the greatest incentive to invest in energy efficiency measures. According to the National Housing Preservation Database[11], the state of Florida has roughly 42,000 units in public housing projects. If the government owner is not responsible for the utility bills, the incentive to invest may decrease, but is likely still greater than the incentive for a private owner, as municipal debt typically carries a lower interest rate than debt issued to private investors.

1.1.2 Consumers (tenants)

A second stakeholder is the consumer. In the case of multifamily dwellings, the consumer is either a tenant or an owner-occupier. Regardless of the consumer's ownership interest in the property, behavior affects resource consumption. The consumer makes the decision to turn off the lights as he or she leaves the room, changes the filter on the air conditioner, or fixes a leaky faucet. If the consumer pays the utility bill directly, then he or she faces the economic consequences of these actions, but if utilities are included in the rent, the economic consequences of these actions may be opaque. For example, the presence of a master water

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[10] "President Obama Announces Commitments and Executive Actions to Advance Solar Deployment and Energy Efficiency", The White House Office of the Press Secretary, May 9, 2014, http://www.whitehouse.gov/the-press-office/2014/05/09/fact-sheet-president-obama-announces-commitments-and-executive-actions-a

[11] National Housing Preservation Database, http://www.preservationdatabase.org/

meter (as opposed to individually-metered units) in a building may dilute the conservation efforts of a particular tenant, as individual tenants receive no clear information about their patterns of energy and water consumption, price signals, and corresponding utility bill impacts.

Consumer behavior is not the only determinant of resource consumption. The physical characteristics of the dwelling also play an important role. The tightness of the building envelope, age and efficiency of the climate control system, integrity of the ductwork, amount and type of insulation, and age and efficiency of the appliances, plumbing and lighting fixtures all affect consumption. Tenants may own their appliances, but in most cases tenants do not have any control over the purchasing or rehab/replacement decisions and maintenance of building envelope features, heating and cooling systems and appliances and fixtures, all of which determine the baseline efficiency of the unit's infrastructure. Even if tenants are willing to make an investment in duct repair or insulation, for example, they may not have the legal right to do so. Therefore, the consumer's ownership interests in the property, and whether the utility bill is included in the rent, need to be addressed in evaluations of the efficacy of any efficiency program.

1.1.3 Utilities

A third stakeholder is the utility. From a purely economic perspective, a utility whose price is set at the average cost to provide service (as opposed to the marginal cost[12]) will only promote reductions in consumption through efficiency and/or conservation programs when the marginal cost to provide service exceeds its marginal price. This occurs most often during the periods of peak demand. Reductions in consumption during other periods will result in lost opportunities or revenues for the utility. A utility's obligations include more than just profit maximization, however.[13] Regardless of their structure, utilities are not permitted to unilaterally spend money and pass the costs through to their customers (the ratepayers). The amount that utilities are permitted to spend on any service depends on their regulator. For investor-owned utilities, this regulator is the Florida Public Service Commission (FPSC). For municipally-owned utilities, it is most often their city council. And for cooperatively-owned utilities, it is the customers themselves.

1.1.4 Utility regulators

A fourth stakeholder is the utility regulator. The role of the FPSC, or the Commission, depends on the utility involved in the program. For an investor-owned utility, for which the Commission regulates rates, the revenue requirement and the rate design are statutory obligations. The revenue requirement principally consists of the sum of: the opportunity cost of the utility's rate base, or the undepreciated capital investment required to provide service, the operating expenditures, and depreciation expenses. The Commission ensures that the utility has the opportunity to recover prudently incurred expenses required to provide service to its customers. Under the provisions of FEECA, the FPSC is required to establish conservation goals every five years for all five investor-owned utilities in Florida, as well as municipal utilities in Orlando and Jacksonville. Once these goals are set, each utility establishes programs, subject to FPSC approval, to enable customers to improve their energy efficiency.

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[12] "Marginal cost" means the cost of providing or consuming the next additional unit of a good or service at a given point in time. The marginal cost to a utility of providing an additional kilowatt-hour (kWh) of electricity varies depending on *when* that electricity is being used, while the marginal cost to the customer for each kWh consumed (the unit price) is relatively stable, changing only when rates change.

[13] Utilities in Florida have an obligation to serve their customers through the provision of safe and reliable service, for example.

The FPSC also ensures that the rates charged by the utility are non-discriminatory. That is, they are not unfairly biased against a particular group of customers. As a result, the Commission may not be able to approve special rates for a particular group of customers if these special rates would disadvantage another group. For municipally and cooperatively owned utilities, the Commission does not have these statutory responsibilities. Regardless of the utility's ownership, the Commission has the ability to act as a resource for stakeholders interested in energy efficiency and may be able to connect interested parties to other agencies that can provide relevant tools and information. Because of their statutory responsibilities, the Commission may have more flexibility to facilitate community-based, rather than utility-based, programs.

1.1.5 State, county and city governments

The fifth stakeholder is the government. For the purposes of this study, the government includes state, county and city governing bodies. Agencies such as FPSC, FDACS, Department of Economic Opportunity (DEO), and Department of Environmental Protection (DEP) all currently implement or oversee programs that relate directly to energy and water efficiency and play a central role in the flow of information. This information is critical for the success of energy and water efficiency programs. Like that of the property owner, the government's role may extend beyond only one stakeholder. Principally, the government is the promulgator of energy policy and establishes goals and priorities. The government is also responsible for evaluating the relative costs and benefits of these policies, and for prioritizing trade-offs that may exist: for example the trade-off between inexpensive electricity and environmental externalities. When the government owns the multifamily housing, its role moves from promulgation to implementation. The government in those cases has direct control over investments in infrastructure. And because the opportunity cost of capital[14] is typically lower for the government than for a private investor, the threshold for energy-efficiency investments should be less constrained. The local government may also be the regulator of a municipally-owned utility, responsible for the determination of its revenue requirement and retail rate design.

A summary and listing of characteristics of the key stakeholders in the market for multifamily rental efficiency opportunities is shown in Table 1-1.

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[14] Defined as the difference in return or benefits – the foregone opportunities – from choosing one capital investment option over other alternatives.

Table 1-1 Stakeholders in the market for multifamily rental efficiency and their characteristics.

Stakeholders in the Multifamily Rental Market	
Stakeholder	**Characteristics**
Property Owner	• Legally-enforced control over infrastructure • May not receive benefits from improvements that reduce electricity bill ("split incentive problem")
Consumer (Tenant)	• Consumers of utility services • May not understand the consequences of consumptions (rates and costs)
Utility	• Obligation to serve customers in service territory • Require regulatory approval to spend on energy efficiency programs
Utility Regulator	• Responsibility for determining the revenue requirement to provide service • Responsible for non-discriminatory rate structure • Flexibility on efficiency may depend on statutory obligations
Local Government	• Promulgator of energy and water policy • Evaluates the relative costs and benefits of policy

While not directly a party in the decision to invest in energy and water efficiency measures, other stakeholders to include in efficiency-related deliberations are interested outside organizations. The organizations might be either government or non-government entities with an interest in promoting efficiency in energy and water use. They also might be sources for technical information, collaborator contacts, and program funding. Examples from the government sector could include the Department of the Interior and the Department of Energy. National non-government entities that promote efficiency initiatives and have been active in identifying opportunities in multifamily housing sector include the American Council for an Energy-Efficient Economy (ACEEE), the Alliance for Water Efficiency (AWE), and the Institute for Market Transformation (IMT). Some non-government organizations such as the National Housing Trust (NHT) and Stewards of Affordable Housing for the Future (SAHF), focus on preserving affordable housing and improving the impact and scale of efficiency retrofit programs. Partnerships with organizations such as these could reduce the burden of funding initiatives on the state.

1.2 Multifamily efficiency opportunities

1.2.1 Benefits of efficiency retrofits

There is a range of benefits associated with the efficient use of energy and water resources. Energy and water consumption imposes costs on society that are not fully realized in the price paid for consumption. Economists call these discrepancies between costs and prices "externalities". Optimally, the policy maker would impose additional costs to equalize the production and social costs associated with these goods, as in additional costs for sulfur dioxide and oxides of nitrogen in power plant emissions. Absent the ability to impose additional costs, a second best policy is to reduce consumption of these goods. Fossil fuels are a finite resource, and problems associated with water shortages are prevalent in many parts of the country. Centralized efficiency programs also allow for economies of scale, as lessons learned to overcome implementation barriers in one type of program can be applied to another. They also allow for economies of scope, as there may be opportunities to address energy and water consumption simultaneously. To identify opportunities, we consider below the differences between conservation and efficiency, statutory and aspirational goals, and utility-based and community-based programs.

1.2.2 Conservation and efficiency

When considering policy options, we distinguish between the terms 'conservation' and 'efficiency'. Conservation, or using less of a resource, is often seen as an attractive policy goal because simply using less is thought of as having an immediate return on investment and being 'free'. That is, it does not cost anything in terms of equipment or material to use less of a resource. But just because conservation does not require investment in equipment does not mean that it is free. When using less by decreasing demand for services (rather than by increasing efficiency), the consumer's utility is being adversely affected because that consumer is incurring the cost of less comfort or convenience, for example. These incurred costs may be relatively minimal: a consumer pauses for a second to remember to shut off a light when she leaves the room. Or, the costs may be relatively significant: a consumer is less comfortable in a home because the temperature setting is higher on the thermostat in the summer months. Therefore, while conservation may yield a monetary benefit to the consumer through a lower utility bill, this monetary benefit may not be sufficient to compensate the consumer for the opportunity cost of his comfort and convenience. Indeed, the failure of a conservation effort may be linked to this economic reality.

Efficiency, which also reduces consumption and resource demands, is the use of fewer resources (energy or water) to achieve the same level of comfort and convenience. A higher efficiency air conditioning unit, for example, can allow the consumer to maintain a given level of comfort while using less electricity. The same case can be made for low-flush toilets: efficiency in water use allows a tenant to receive the same level of service with a lower water footprint and utility bill. The distinctions between these two terms is summarized in Table 1-2.

Table 1-2 Conservation vs. efficiency

Term	What it means
Conservation	• Using less of a resource by altering behavior • Costs expressed in terms of comfort and convenience • Benefits through reduction in utility bill
Efficiency	• Using less of a resource by purchasing more efficient appliances and fixtures • Costs expressed in terms of equipment costs • Benefits through reduction in utility bill

1.2.3 Statutory and aspirational goals

> *"It might be best to address aspirational goals with community-based programs, and statutory goals with utility-based programs.*

With any policy it is also important to distinguish between statutory goals and aspirational goals. Statutory goals are expressed through the legislative or regulatory framework and represent policy with legal standing. For example, a statutory goal might be a code requirement that showerheads have a flow of less than 2.5 gallons per minute. The policy would also typically include any restrictions or prerequisites for the technologies employed and a consequence or penalty for noncompliance.

Aspirational goals, on the other hand, represent the desires of society or a subgroup of society, and these goals have no legal standing. Examples of aspirational goals might be the stated desire to produce more electricity from renewable sources or to use 30% less water by installing water-efficient appliances and fixtures. The importance of the distinction may not always be clear in the present, but as technologies and societal preferences change, the distinction can become critical. If the pursuit of an aspirational goal ever conflicts with a statutory goal, the outcome is effectively predetermined: the courts will assure that the statutory goal prevails. Therefore, the strategies for addressing aspirational goals and statutory goals will almost certainly differ. In the matter of energy efficiency, it might be best to address aspirational goals with community-based programs, and statutory goals with utility-based programs.

1.2.4 Utility-based and community-based programs

Utility-based programs apply across the utility's service territory. If these programs include elements with the potential to impact the utility's revenue requirement or bias the utility's rate structure in a manner that is not commensurate with its allocated costs to provide service, they may be subject to approval from the utility's regulatory authority. Utilities play an active role in utility-based programs, ranging from contracting or performing resource evaluations and market surveys to installing direct control equipment on a customer's air conditioning unit or pool pump. The main advantage of utility-based programs is the opportunity to take advantage of scale economies and the statutory framework that are used to implement them.

Community-based programs, however, do not depend on direct action from the utility or its regulator. They may be more flexible and focus on awareness and benefits within a subset of the utility's service territory or customer base. Community-based efficiency programs can be tailored to the preferences and resources available in each community. They might include less aggressive measures that try to secure high participation at low cost, often as a precursor to more aggressive measures. They might also try to introduce programs in communities that are traditionally harder to reach yet are important audiences to engage with respect to other public policy initiatives (e.g., affordable housing preservation). They may include the development of local infrastructure with the potential to foster economic growth. Finally, they may include demand reduction programs aimed at reducing the needs for transmission or distribution infrastructure in the community. These community-based programs can be implemented without regulatory oversight and cost-effectiveness tests that take lost utility revenues into account. Despite the fact that community-based programs do not depend on the utility, it is still important to engage the utility as a resource for implementation. The utility may be a in a unique position to provide usage data and access to contractor networks, for example, as well as serve as an educational resource for program organizers.

> "***The split incentive challenge***: *unless owners receive a benefit sufficient to compensate for the cost of their capital, they will have little to no incentive to invest in efficiency.*

1.3 Challenges

Six main challenges to capturing multifamily efficiency potential are identified in this section: 1) "split incentives"; 2) information, awareness and behavior gaps; 3) incomplete and/or unclear price signals; 4) the "rebound effect"; 5) cost-effectiveness requirements/constraints; and 6) program structure constraints.

1.3.1 The "split incentive" problem

The central and most widely cited challenge associated with efficiency program implementation is the so-called "split incentive" problem. While consumers can independently invest in lower-cost measures such as efficient light bulbs and appliances (if they own them), larger investments required to capture efficiency potential at scale are typically the responsibility of the property owner. Unless owners receive a benefit sufficient to compensate for the cost of their capital, they will have little to no incentive to replace air conditioning units or water heaters.

1.3.2 Information, awareness and behavior gaps

A second challenge relates to the value of information (utility consumption and billing data) and gaps in consumer awareness and understanding of their consumption behaviors and efficiency opportunities. Consumers demand energy and water resources not for the kilowatt-hours or gallons themselves, but for the services they provide: for survival, comfort, and convenience. One might expect a well-informed consumer to make rational choices about their energy and water use. However, many consumers are not well-informed regarding their consumption patterns, opportunities to improve efficiency, and consequences of their energy and water use behaviors. Consumers can hear the utility conservation staff tell them that the filter on their air conditioner should be changed once a month. But actually changing a filter requires both the effort and expense of purchasing a new one, and the effort to change it on a regular schedule. What may not be clear are the consequences of not modifying behavior to improve the operational efficiencies of one's home. The costs to the consumer of changing an air filter are clear—the consumer has to buy a new one and change it—while the costs of not changing it may be very difficult to isolate and account for in decision making. In this manner, the consumer is unable to weigh one cost against another, and may simply choose to do nothing. The failure to modify their behavior is exacerbated by the fact that, in any given month, consumers are paying for utility services they used four to six weeks earlier, depending on their billing cycle. This time lag between electricity consumption and the receipt of the utility bill further clouds their understanding of the consequences of their inactions.

1.3.3 Incomplete and/or unclear price signals

Another challenge in the market for residential efficiency is the lack of direct and timely feedback through clear price signals. Even in situations where multifamily units are individually metered, most tenants are not aware of unit prices for water and energy, and—for water in particular—the marginal bill savings from conservation and efficiency behaviors may represent a small share of their overall utility bill. Direct load control programs, where the utility controls the operation of certain appliances, can alleviate the behavioral and price signal challenges associated with conservation, but many tenants distrust the perceived intrusion into their homes.

> *"Most tenants are not aware of unit prices for water and energy and…savings from conservation and efficiency behaviors may represent a small share of their total utility bill.*

1.3.4 The "rebound effect"

A challenge often cited by both critics and proponents of efficiency programs is the "rebound" or "take-back" effect, which occurs when gross savings achieved through efficiency improvements are partially or completely offset by increased demand for services provided by the improved equipment. For example, a new central air conditioner technically uses electricity 10% more efficiently than the system being replaced. When made aware of this efficiency improvement, the consumer responds by lowering the thermostat setting to attain a more comfortable indoor environment than they would have with their old system. Therefore, the efficiency measure, which technically could lead to a 10% savings, only leads to a savings of 5% or less.[15] To moderate the rebound effect, most efficiency programs provide consumers with direct

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[15] Gillingham, Rapson, and Wagner (2014) provide a useful overview of the academic research relating to the

consultation (e.g., as part of an audit) and relevant educational materials (informational brochures or web-based content) when new efficiency measures are installed in their homes. However, consumers may still decide to demand more services from an efficient system or appliance if the benefit they receive from increased comfort and convenience outweighs the cost of the resource. This rebound effect is most pronounced where existing systems did not provide the service at an affordable cost. Thus the non-working air conditioner may not have been run at all, with tenants opening windows instead. Once the old air conditioner is replaced and the new unit utilized, the electric bill will increase.

1.3.5 Cost-effectiveness requirements

The adoption or success of an efficiency program may also be constrained by the tests used to establish program cost effectiveness. Utility-based programs that require approval of the regulator have to meet certain cost-benefit tests to justify their implementation. Each test conveys a different notion of what should be counted as a cost and a benefit, and the idea of the 'correct' test to employ is a matter for debate. The two most common types of tests, the Rate Impact Measure (RIM) test and the Total Resource Cost (TRC) test, are often at the fore of this debate. The RIM test assesses whether a customer's rates will increase as a result of the program, while the TRC test assesses whether the total cost for energy will increase as a result of the program. The tests themselves, and the values conveyed, determine whether the program is approved.[16]

1.3.6 Program structure constraints

Sometimes, the system-wide scope of utility-based programs, which is typically considered an advantage, can also be a disadvantage. Because the program scope is system-wide, the utility and its regulator must aggregate customer values across the service territory. That is, what is important must be consistent across a broad customer base and geographic area. In addition, utility-based programs need to be concerned that the program does not bias the rate structure in a manner that is not commensurate with the allocated costs of service.

There are challenges associated with community-based programs as well. Because their implementation is not centralized, a local organization or entity is necessary to coordinate them. In addition, while community-based programs may be able to easily promote behavior change—through peer-awareness programs, for example—programs that require significant capital investment may be more difficult to implement.

1.4 Strategies

The strategies for implementing efficiency policies, programs and measures can be classified into both long-term and short-term approaches. Long-term strategies may require multiple changes to the laws relating to the provision of utility service in Florida or to the regulatory requirements governing such service. These strategies are useful to discuss, but may be beyond the scope of any one entity. Short term strategies, however, would require little or no revision of the current legal and regulatory framework.

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magnitude of the rebound effect. In a survey of empirical data, Greening, Greene, and Difiglio (2000) conclude that rebound effects are "very low to moderate" in magnitude.

16 These cost-effectiveness tests are described in further detail in Section 3.3: Cost-benefit analysis of Florida's efficiency programs.

1.4.1 Long-term (broad in scope)

For utility-based programs, the long term strategy of introducing decoupling would mitigate the economic disincentive that utilities have to invest in efficiency measures. Decoupling would essentially dissolve the bond between the utility's sales and its revenues. This could be accomplished through the imposition of a revenue cap, where a utility's revenues are allowed to grow at a given rate over time. The chief disadvantage of a revenue cap is that as sales fluctuate and revenue remains relatively stable, prices have to vary over time. This pricing volatility may create disincentives for customers to participate in efficiency programs, as the incentives for doing so may become less certain at any given point in time.

> *"It may be more difficult to change repetitive behavior than one-time behavior.*

McKenzie-Mohr's seminal work[17] on community-based social marketing (CBSM) suggests a long-term strategy of community-based efficiency programs. He outlines three questions to address regarding the types of efficiency behaviors to promote. First, what is the potential impact of the behavior? That is, how do we measure the 'good' that the behavior accomplishes (e.g. reduction in greenhouses gases or potable water consumption)? Second, what are the barriers that exist to behave in this manner? These barriers can be psychological, economic, or geographical. He cites focus groups, observational studies, and survey research that can all be used to identify these barriers, and for community-based programs within a small geographical area, the cost to identify these barriers is likely low. Finally, he cites the need to identify whether the resources exist to overcome these barriers. It may be more difficult to change repetitive behavior (changing the filter on an air-conditioning unit, thermostat settings, etc.) than one-time behavior (purchasing an energy-efficient appliance). This suggests a strategy to time CBSM interventions with key decision points that affect multifamily units' base performance (e.g., point of sale, refinance, inspection, rehab, renovation or property owner or manager license renewal).

Johnson[18] proposes ten best practices for efficiency programs in multifamily homes in a report published by the American Council for an Energy-Efficient Economy (ACEEE). These practices provide a useful framework for evaluating proposed programs and consist of:

1. providing a single point of contact for program services;
2. incorporating on-bill or low-cost financing to minimize upfront costs;
3. integrating direct installation and rebate programs;
4. streamlining rebates and incentivizing in-unit measures;
5. coordinating programs across different types of utility services;
6. encouraging deeper retrofits through escalating incentives;
7. serving both low-income and market-rate multifamily households;
8. combining customer-funded programs with public funding at the time of housing refinance;
9. partnering with the local multifamily housing industry, and
10. offering multiple pathways for participation.

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[17] McKenzie-Mohr, Doug (2000) "Promoting Sustainable Behavior: An Introduction to Community-Based Social Marketing", *Journal of Social Issues* Vol. 56, No. 3 pp. 543-554.

[18] Johnson, Kate (2013) "Apartment Hunters: Programs Searching for Energy Savings in Multifamily Buildings", Report E13N December 2013, American Council for an Energy-Efficient Economy, Washington, DC.

1.4.2 Short-term (rapid-launch; narrow in scope)

> *"The easiest and most cost-effective programs to implement quickly might be those where fewer entities are involved.*

There may be greater immediate opportunities in short term strategies—rapid-launch policies and programs that leverage existing resources—as these do not carry the same costs to revise the market or regulatory structure under which utilities operate. In fact, some of these short term strategies can benefit by minimizing the number of entities involved in the process, in turn reducing the costs of interactions (the so-called 'red tape' of bureaucracy). The potential barriers for program implementation can increase as the number of entities increases. The more entities involved, the greater the potential for statutory barriers arising from the rights and responsibilities of those entities, and conflicts between the relative values. That is, the perception of what is important may differ among the stakeholders, and stymie the process. As a result, the easiest programs to implement quickly and effectively might be those where the number of entities is minimized.

Community-based programs, for example, reflect the values of the individual communities that sponsor them. To the extent that they do not impact the utility's revenue requirement, these programs do not require approval from the government or the regulator. As a result, the regulator or the government is free to facilitate the acquisition of additional information or contact with other government agencies that the program organizers require. These contacts may be able to efficiently and effectively guide financing and other resources to community groups.

More centralized programs with fewer entities involved will also minimize potential statutory conflicts. All five stakeholders are critical in the energy efficiency process, but there are instances where two or more of the stakeholders are represented by a single entity. For example, programs aimed at public housing in cities—such as Orlando, Jacksonville or Gainesville—might involve only two entities: the customers and the city. In this case, the city is the property owner, regulator, government, and owns the electric and water utility. Potential conflicts among stakeholder incentives may be decreased markedly and it might be easier for local government authorities to manage program relationships and work flows.

Programs where property owners reap a financial benefit from efficiency investments also help to alleviate the split incentive problem. Programs that target properties where the owner is also a consumer, more common in duplex and triplex houses, would mitigate the split incentive problem. Additional solutions that have been offered to combat the split incentives problem include[19]: programs that do not require the owner to make the up-front investment; allowing the owner to recoup the energy-efficiency investment by adjusting rents by a roughly equivalent amount; and implementing provisions to ensure that both tenants and property owners share the benefits from improved efficiency (e.g., shared savings contracts).

Additional financial benefits are not necessarily limited to a reduction in the utility bill. According to the National Housing Preservation Database, Florida has roughly 133,000 units that receive subsidies under programs sponsored by the U.S. Department of Housing and Urban Development (HUD). Owners of these properties receive a benefit from the renewal of these subsidies, and could qualify for additional incentives to advance the efficiency of these units. Therefore, the owners of properties subsidized by HUD or receiving other types of assistance might be important targets for efficiency improvements.

[19] Benningfield Group, Inc. 2009. U.S. Multifamily energy efficiency potential by 2020.

1.5 Summary context for evaluating multifamily efficiency opportunities

- The market for efficiency retrofits to multifamily rental properties is complex and occupied by numerous stakeholders with diverse and often conflicting incentive structures.
- A central challenge to increasing activity in this marketplace is the so-called “split incentive” whereby property owners (landlords) who are responsible for decisions to invest in efficiency measures lack incentives to do so because they expect the investment payoff will accrue to tenants.
- One of the most important strategies to address the split incentive is understanding and communicating the full benefits that property owners could capture by investing in the energy and water efficiency of their multifamily buildings.
- Because the type and magnitude of savings potentials vary across locations, properties, buildings, household characteristics and retrofit measures, it is important to calibrate savings models and target retrofits. Model results and lessons learned can then be used by owners as tools to evaluate alternative investment opportunities and weigh risks.
- Ultimately, an owner’s decision engage in a retrofit project may depend upon the magnitude of expected savings and the non-energy benefits that they might realize over the long run from their efficiency investments.

“One of the most important strategies to address the split incentive is understanding and communicating the full benefits that property owners could capture by investing in the energy and water efficiency of their multifamily buildings.

The next section describes efficiency retrofit packages suitable for application to multifamily rental properties in Florida and models the potential savings from retrofits to typical units.

2. Savings Potential

Residential buildings in the U.S., and multifamily housing in particular, offer the promise of substantial energy, water and financial savings through efficiency, with typical savings projected in the range of 25-35% relative to business-as-usual scenarios. In 2009, McKinsey and Company[20] estimated that building owners could save 9.1 quadrillion BTUs of energy (23% of projected demand) by 2020 through energy-efficiency investments. The study looked specifically at interventions with a positive benefit-to-cost ratio: those for which the expected energy savings are greater than the upfront equipment costs, adjusting for time value of money. The study concludes that "energy efficiency offers a vast, low-cost energy resource for the U.S. economy—but only if the nation can craft a comprehensive and innovative approach to unlock it… If executed at scale, a holistic approach would yield gross energy savings worth more than $1.2 trillion."[21]

Also in 2009, the Benningfield Group reviewed several studies quantifying energy-efficiency potential in existing U.S. multifamily buildings and projected potential savings by 2020 of 51,091 GWh of electricity.[22] This magnitude of savings is enough to provide electricity to over 4.8 million homes for one year.[23] The Benningfield Group also found that, under certain assumptions, "an estimated investment of $8B for multifamily energy-efficiency improvements made over the next 11 years (2009-2020), tenants and property owners would realize energy cost savings of approximately $9B annually."[24] Of particular relevance to this study, Florida ranked seventh nationally in the density of multifamily homes, accounting for 27% of all households, and was estimated to have a statewide energy savings potential of 2,886 GWh[25] (enough electricity to power over a quarter of a million homes for a year[26]).

Furthermore, a substantial share of the benefits from energy-efficiency investments would accrue to low income households, and much of this potential can be captured through improvements to multifamily rental housing. McKinsey and Company estimated the annual energy savings potential of existing low-income homes—again from 2009 to 2020—at $7 billion, with 23% of this potential in the multifamily low-income housing sector (16 million homes).[27] Given that low-income households tend to bear a disproportionate share of the burden of inefficiencies in rental housing and have the most to gain from offset utility bills, this market—typically characterized as ripe with "low-hanging fruit"—also represents an important complement to affordable housing preservation initiatives.

This section of our study provides a locally-relevant context for these national and sector-specific projections of energy-efficiency savings potential. To do so, we first characterize Florida's multifamily housing stock and then model energy and water savings potential from efficiency retrofits to *typical Florida*

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[20] McKinsey & Company. (July 2009). Unlocking energy efficiency in the US economy. New York. Page 91, http://www.mckinsey.com/client_service/electric_power_and_natural_gas/latest_thinking/unlocking_energy_efficiency_in_the_us_economy. Accessed November 2014.

[21] *Ibid.* Page 1.

[22] Benningfield Group, Inc. (2009). U.S. Multifamily energy efficiency potential by 2020.

[23] Based on conversion using the U.S. EPA's Greenhouse Gas Equivalency Calculator, http://www.epa.gov/cleanenergy/energy-resources/calculator.html. Accessed December 2014.

[24] Benningfield Group, Inc. (2009). U.S. Multifamily energy efficiency potential by 2020. Page 11.

[25] *Ibid*. Page 13.

[26] Based on conversion using the U.S. EPA's Greenhouse Gas Equivalency Calculator, http://www.epa.gov/cleanenergy/energy-resources/calculator.html. Accessed December 2014.

[27] McKinsey & Company. (July 2009). Unlocking energy efficiency in the US economy. Page 39. New York, http://www.mckinsey.com/client_service/electric_power_and_natural_gas/latest_thinking/unlocking_energy_efficiency_in_the_us_economy. Accessed November 2014.

multifamily rental units. Section 2.1 explains the original data sources used to compile housing data and estimate savings potential. Section 2.2 provides detailed statistics on housing cost burdens (i.e., rent and utility costs as a share of multifamily renter households' incomes), providing important context for the benefits of capturing savings potential in this market. Section 2.3 describes the typical structural and household characteristics of Florida's existing multifamily properties, buildings and rental units. Sections 2.4 and 2.5 define the base energy and water parameters/features, respectively, of typical units and model the potential technical savings from efficiency retrofits to these base units. While the energy and water savings potentials are modeled separately, both analyses estimate savings from "shallow" and "deep" retrofit package scenarios, and both use consistent assumptions and methods to compute unit-level savings potential. Section 2.6 summarizes results of the retrofit savings potential analysis and applies them to estimate energy, water and utility bill savings at scale under different market penetration scenarios.

Water consumption is an increasing concern for Floridians as demand increases with growing population, and aquifers are reaching or exceeding the limit of sustainable withdrawals in many locations. Residential indoor water consumption offers opportunities for significant, low cost efficiencies, particularly in multifamily properties where the number of persons per plumbing fixture is usually greater than in single family housing, as most apartments have only one bathroom. Low cost modifications to fixtures can reap large water savings. "If just half of Florida's households replaced their older, inefficient toilets with WaterSense labeled models, the state could save nearly 38 billion gallons of water annually—enough to supply every household in Orlando for four years."[28]

2.1 Data sources

The data in this section are primarily from three sources: the 2009 Residential Energy Consumption Survey (RECS), the US Census Bureau 2013 American Community Survey (ACS), and the Shimberg Center for Housing Studies. The first two data sets (RECS and ACS) are extrapolations based on detailed surveys of representative homes and the Shimberg data are compiled from Florida counties' property appraiser databases.

The 2009 RECS survey interviewed 4,382 households nationwide and includes measured square footages of residences and many details about the structure as well as energy consuming equipment and appliances in each household.[29] The data from the Florida households surveyed in the 2009 RECS was used to create baselines for all energy models. The 2013 ACS 1-year estimates were the basis for total housing units and occupancy rates.[30] The data from this survey were downloaded and filtered for 2,661 Florida multifamily rental properties with five or more units per building to determine unit and household characteristics such as household demographics, numbers of bedrooms and bathrooms, reported income and housing cost burden data. The Shimberg data were used to determine the total numbers of rental units and the percentages of assisted units per housing type, as well as the decades of building construction.

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28 EPA Water Sense, Florida State Fact Sheet 508, June 2013, http://www.epa.gov/watersense/docs/florida_state_fact_sheet_508.pdf

29 Department of Energy, Residential Energy Consumption Survey Files, http://catalog.data.gov/dataset/residential-energy-consumption-survey-recs`all-data-2005, last updated October 2, 2014.

30 US Census Bureau, ACS, Table DP04 Selected Housing Characteristics 2013 ACS 1-year Estimates, http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_13_1YR_DP04&prodType=table

The best and most current source of compiled energy data broken out by housing type is the DOE Energy Information Administration's 2009 Residential Energy Consumption Survey (RECS).[31] The survey is very detailed and is national in scope. Breaking it out by housing type and state reduces the sample size. Nevertheless, it is a good starting point for the task of determining typical characteristics of the components affecting energy use in Florida's multifamily rental housing stock. Unless otherwise noted, all statistics given in this section were extracted from either the Florida Housing Data Clearinghouse[32], the 2009 RECS survey, or the 2013 U.S. Census American Community Survey (ACS)[33] for multifamily rental units. Some characteristics, such as unit size are closely related to the number of bedrooms, while the date of construction is important for linking to the building construction, energy and plumbing codes in effect when they were built.

2.2 Renter household demographics and housing cost burdens

Florida's multifamily rental housing has on average 1.7 occupants per unit, with children under 5 years old present in 24% and children 5-17 years old present in 39% of households. Another 47% of households did not have children. People aged 65 years or older occupy 22% of multifamily rental housing. In many of these units, utility costs—especially water bills—are folded into the rents. It is common for water to be metered at the building rather than unit level (master-metered), but electricity is usually metered separately for individual units: 68% of units are master-metered for water and 11% are master-metered for electricity.[34]

> *"About 6 out of 10 multifamily rental households are likely to have difficulty paying their rent and utilities.*

A household is considered cost burdened if the housing expenses exceed 30% of income. This threshold is a somewhat arbitrary divide, but it reflects a standardized ceiling for housing costs, above which households are increasingly likely to have difficulty paying basic living costs. Statewide, the housing burden for households living in rental multifamily units (rent plus utilities) average 43% of household incomes.[35] However, averages tell only part of the story about the burden of housing costs on Florida's tenant individuals and families. Household gross incomes for this group average $41,140, with the median falling lower at about $30,000 per year. A total of 58% of multifamily rental households (not including condominiums) are likely to have difficulty paying their rent. The fact that higher cost burdens fall disproportionately on renter households with low incomes is evident when we segment the total group into three smaller cost-burden categories: those spending less than 30% of their respective incomes on combined rent and utility expenses (not cost burdened), those spending 30-50% (cost burdened), and those spending greater than 50% (severely cost burdened). These data are summarized in Figure 2-1.[36]

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31 Energy Information Administration, Residential Energy Conservation Survey Results 2009, http://www.eia.gov/consumption/residential/data/2009/, final release date May 2013.

32 Queries for Florida housing statistics used in this study were generously provided to the study team by Anne Ray at the University of Florida Shimberg Center for Housing Studies. Information about and data from the Florida Housing Data Clearinghouse are accessible at http://flhousingdata.shimberg.ufl.edu/about.html

33 Extracted and summarized from US Census, American Community Survey, downloadable Public Use Microdata Sample (PUMS) Files, http://www.census.gov/acs/www/data_documentation/data_via_ftp/

34 Note that these numbers add to greater than 100% because of households that have children in both age group categories. Data selected and summarized from: US Census, American Community Survey, downloadable Public Use Microdata Sample (PUMS) Files, File acs2013_1yr/, 23-Oct-2014 07:48, http://www2.census.gov/

35 *Ibid*.

36 *Ibid*.

Not cost-burdened households (housing costs less than 30% of income): 42% of units fall into this category, whose occupants are not likely to have a problem paying their rent and utility bills. The first bar illustrates these renters. They have a median income of $55,000 and their median rental costs are only 20% of that income.

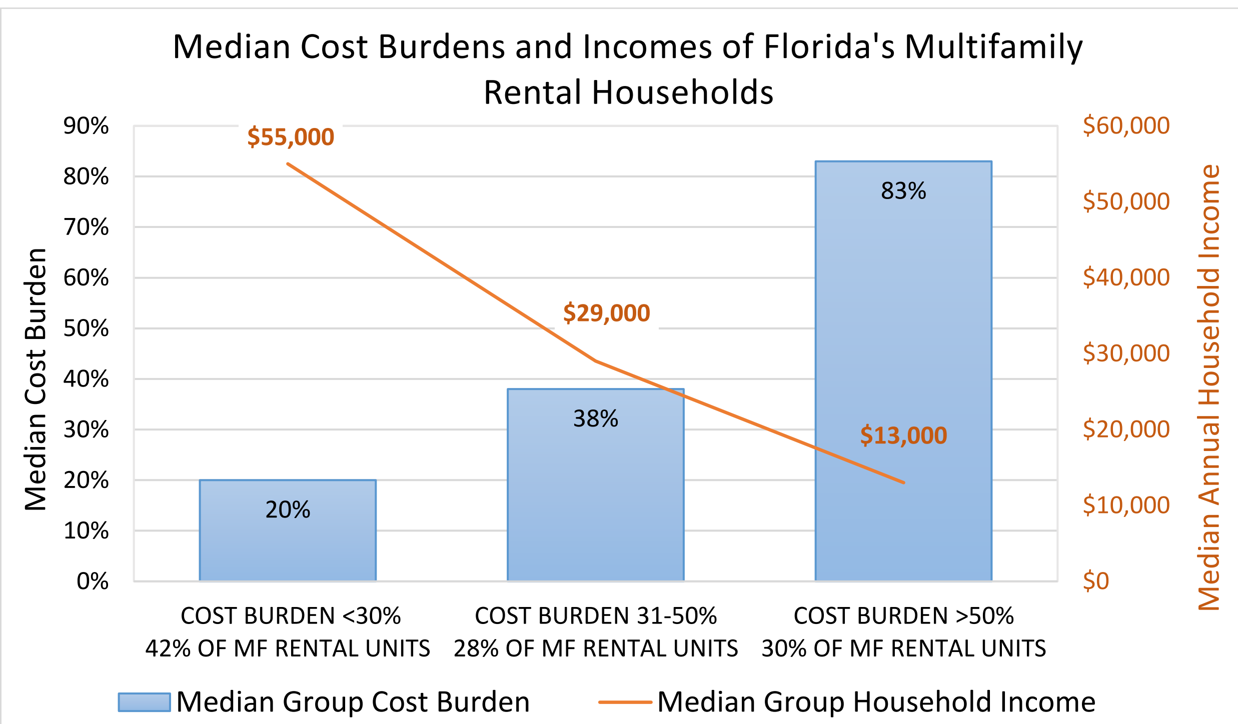
Cost-burdened households (housing costs 30%–50% of income): 28% of units fall into this category. The second bar represents this group of households. This middle group is less affluent with a median household income of $29,000, of which 38% goes to pay housing expenses.

Severely cost-burdened households (housing costs more than 50% of income): 30% of units fall into this category. The third bar shows that the median amount these households pay in rent is 83% of their income, and their median income is only $13,000.

A subset of severely cost-burdened households have a cost burden equal to or greater than their income. Approximately 11% of multifamily rental households fall into this category. This subset has a median income of only $7,000 per year.

These data underscore the need for housing cost relief for low-income renter households. Efficiency retrofits are one vehicle to reach them and—potentially—to help moderate or reverse the trend of rising housing cost burdens.

Figure 2-1 Florida multifamily housing cost burdens and incomes (Data source: 2013 U.S. Census, American Community Survey)



Inefficiencies in rental housing impose real costs on Florida's low-income families. Nearly three-quarters of low-income tenants in Florida's most populous counties pay at least 40% of their income for their housing costs—rent and utilities.[37] Targeting retrofit activity to the greater metro areas of Miami, Tampa, Jacksonville and Orlando, where affordable rental housing is in short supply, and implementing efficiency retrofits to reduce their utility bills, could be an effective strategy for reaching a large number of the state's low-income households. Nearly 60% of cost-burdened renter individuals and families (over 430,000 households) live in these regions [38] (Figure 2-2). Yet rental properties outside of these urban areas still represent an important target demographic for efficiency retrofits: 30% of rental households in mid-sized counties and 28% in small counties were also cost-burdened in 2013.[39]

A second group of households—those headed by older citizens—may also be a suitable target for assistance with energy-efficiency programs. About 30% of cost-burdened households in the state are headed by a family member who is at least 55 years old, and 9% are headed by someone who is at least 75 years old.[40] These households are likely to be living on fixed incomes and having difficulty meeting rising housing costs.

> *"Efficiency retrofits are one vehicle to reach low-income households with potential relief to help offset rising housing costs.*

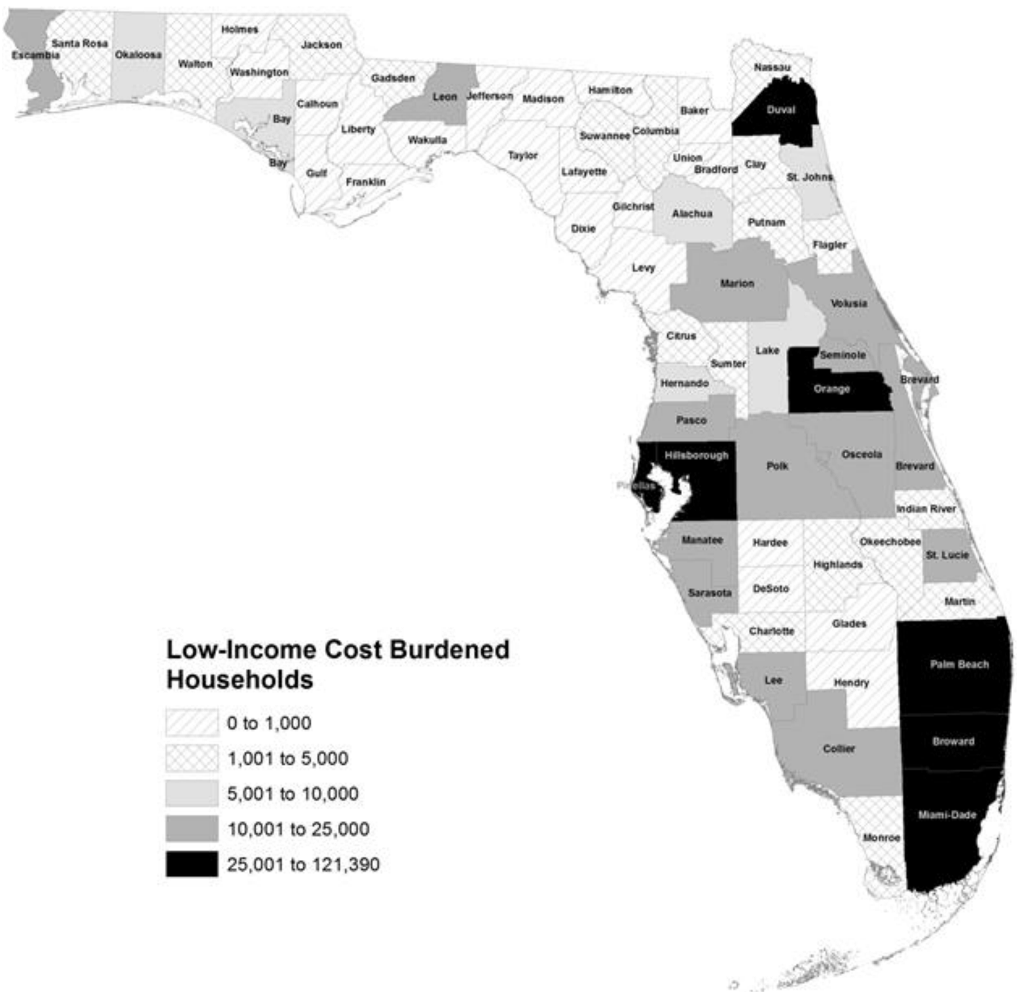
[37] Shimberg Center for Housing Studies. (2013). 2013 Rental Market Study: Affordable Rental Housing Needs, page13, http://www.shimberg.ufl.edu/publications/Full_RMS_Needs.pdf. Accessed December 2014.

[38] *Ibid,* page 9.

[39] *Ibid*, page 9.

[40] Shimberg Center for Housing Studies. (2013). 2013 Rental Market Study: Affordable Rental Housing Needs, page 2, http://www.shimberg.ufl.edu/publications/Full_RMS_Needs.pdf. Accessed December 2014.

Figure 2-2 Number of low-income (≤60% AMI), cost-burdened (>40%) renter households by County in Florida, 2013.
Image provided courtesy of Anne Ray, University of Florida Shimberg Center for Housing Studies. See page 12 at http://www.shimberg.ufl.edu/publications/Full_RMS_Needs.pdf



2.3 Housing stock characterization

2.3.1 Property-level characteristics

As of 2013, there were over 8.4 million occupied housing units in Florida, approximately 30% of which (2.7 million) were classified as multifamily (*including* condominiums, retirement complexes and others) (Table 2-1).[41] Vacancy rates in overall rental units (single and multifamily) were about 11.4 percent.[42] Occupied rental multifamily apartments (*excluding* condominiums and other owner occupied units) totaled about 1.32 million units or 16% of all occupied housing.[43] Florida's multifamily rental properties account for the largest share (over 90%) of affordable housing units[44] and represent an important target market for efficiency retrofit policies and programs.

Table 2-1 Number of Florida housing units by type (Data source: UF Shimberg Center for Housing Studies).

Florida Housing Units by Type				
Housing Type			**No. of units**	**Percent of all housing**
Single Family			5,011,490	60%
Condominiums			1,541,875	18%
Multifamily:	**No. of units**	**% MF**		
2-4 units	296,675	23%		
5-9 units	73,718	6%		
10 or more	946,432	72%		
Total Multifamily			**1,345,164**	**16%**
Retirement Housing			29,400	0.3%
Other (Mobile homes, cooperatives, boats, etc.)			487,171	6%
Total—All Residential			**8,415,100**	**100%**

41 US Census Community Facts, http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=CF

42 Table DP04, Selected Housing Characteristics, 2008-2012 American Community Survey 5-Year Estimates, http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_12_5YR_DP04&prodType=table

43 Based on statistics provided by Anne Ray, Shimberg Center for Housing Studies as queried from the Florida Housing Data Clearinghouse and Assisted Housing Inventory databases, accessible at http://flhousingdata.shimberg.ufl.edu/about.html

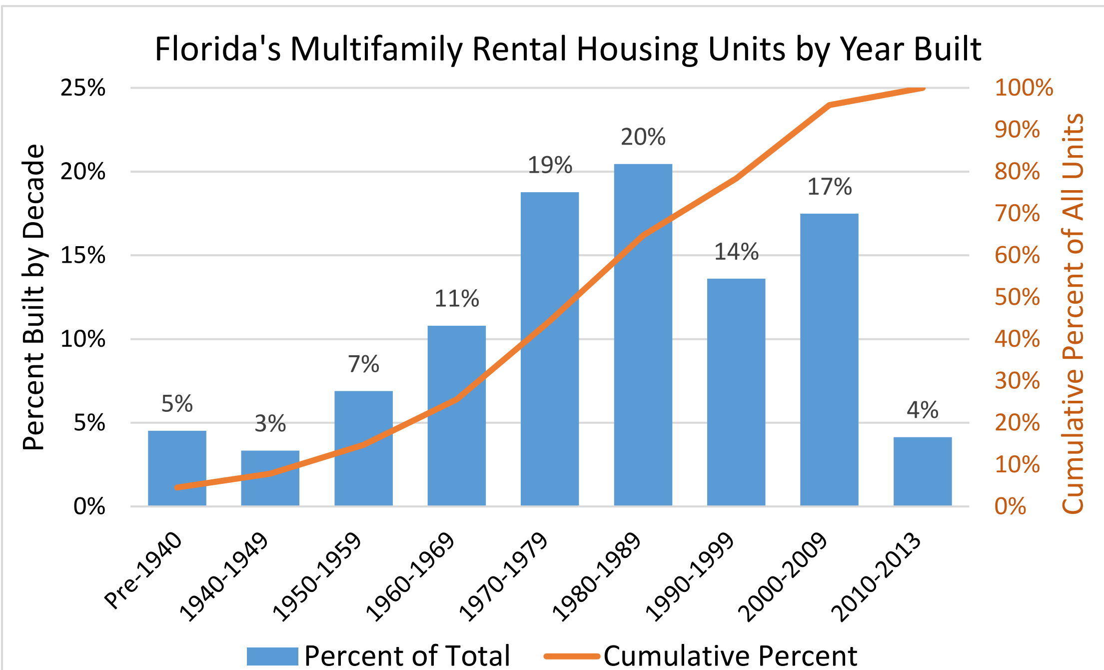
44 *Ibid*.

The date of construction is important for predicting the energy and water efficiency of buildings (Figure 2-3 and Figure 2-4).[45] Specific statistics for the share of different housing types by decade built are shown in Table 2-2 and Table 2-3. The median year built for various housing types in Florida are:[46]

• Single family	1986
• Condominiums	1987
• Multifamily rental, 9 or fewer units	1973
• Multifamily rental, 10 or more units	1979

About half of multifamily units were built prior to 1980, which means that they were constructed before energy and water efficiency codes were in effect in Florida. Of course, some units will have been renovated since construction, but the group as a whole is older than single family and condominium homes and has a larger potential for cost-effective efficiency improvements.

Figure 2-3 Florida multifamily rental housing: percent of units by year built.



[45] US Census, American Community Survey, downloadable Public Use Microdata Sample (PUMS) Files, http://www.census.gov/acs/www/data_documentation/data_via_ftp/

[46] Florida Housing Data Clearinghouse, Housing Unit Characteristics, Year Built—Mean and Median, 2013, http://flhousingdata.shimberg.ufl.edu/a/construction_sales?report=a2_year_built&report=a3_size_type&report=a4_size_year_built&action=results&nid=1&go.x=22&go.y=14

Figure 2-4 Florida code changes affecting energy and water base efficiencies in existing housing. (Energy data from FSEC,[47] water data from Florida Building Construction Standards[48,49])

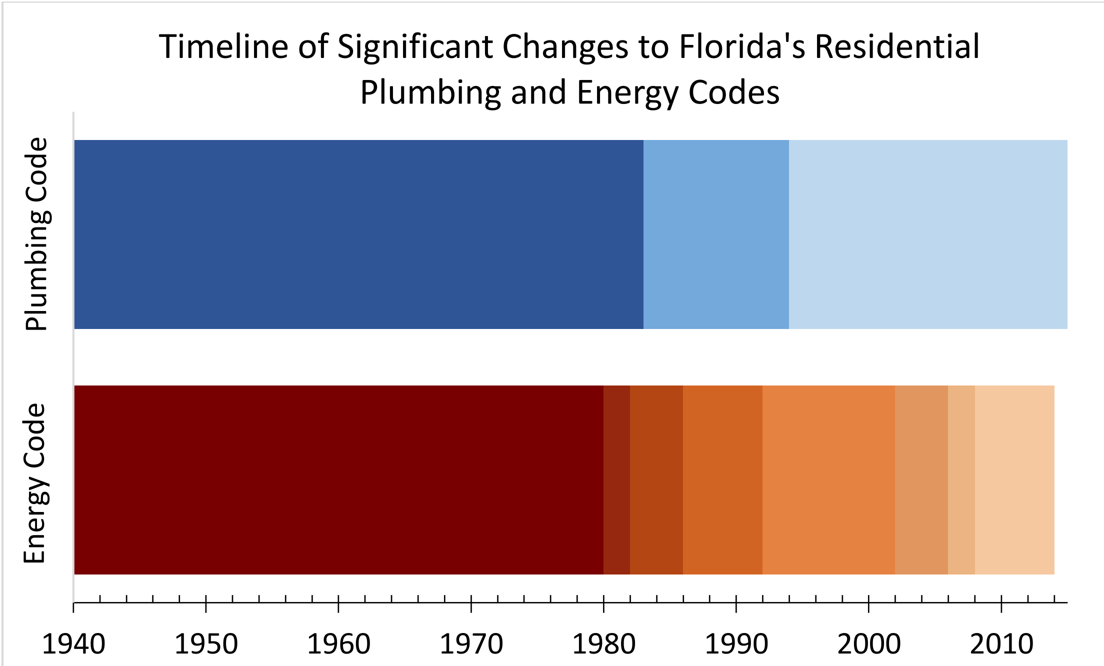


Table 2-2 Percent of Florida housing types by construction period.

Florida Housing Types by Construction Period						
Construction date	**Single family**	**Condominiums**	**Multifamily**	**Retirement**	**Assisted and public housing**	**Other**
Before 1980	39%	37%	46%	19%	21%	36%
1980 to 1989	18%	29%	20%	35%	16%	28%
1990 to 1999	17%	12%	13%	28%	22%	21%
Since 2000	25%	22%	21%	18%	34%	16%
Unknown	—	—	—	—	8%	—
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

47 Florida Solar Energy Center, Effectiveness of Florida's Residential Energy Code: 1979:2009, June 2009, http://www.fsec.ucf.edu/en/publications/pdf/FSEC-CR-1806.pdf

48 Florida Building Construction Standards, F.S. Chapter 553.14, 1983, http://www.law.fsu.edu/library/collection/flastat/FlaStat1983/vol2/FlaStat1983v2_OCR_Part34.pdf

49 EPA WaterSense, National Efficiency Standards and Specifications for Residential and Commercial Water-Using Fixtures and Appliances, http://www.epa.gov/watersense/docs/matrix508.pdf

Table 2-3 Number of parcels, units and percent of total Florida multifamily housing by construction period.

Parcels, Units And Percent of Total by Construction Period			
Construction date	**Parcels**	**Residential units**	**% of Total**
1929 or Earlier /Missing Value	12,559	39,883	3%
1930 to 1939	6,446	19,857	1%
1940 to 1949	13,323	42,472	3%
1950 to 1959	26,080	83,070	6%
1960 to 1969	32,204	208,295	15%
1970 to 1979	31,907	241,230	18%
1980 to 1989	26,920	272,471	20%
1990 to 1999	6,826	181,149	13%
2000 to 2009	10,047	232,873	17%
2010 or Later	1,342	55,194	4%
Total	**16,7654**	**1,376,494**	**100%**

2.3.2 Unit-level characteristics

Considering all multifamily rental units, two-bedroom units (46%) are slightly more common than one-bedroom or studio units (44%), followed by three or more bedrooms (10%) according to the 2013 ACS data. Average conditioned area per unit is just under 1,000 square feet, based on the 2009 RECS data. ACS data indicate that almost all units have a complete bathroom and complete kitchen (found in about 99% of multifamily rental units), and 92% have electric heating (only 3% used natural gas for heating and 4% had no central heating equipment/were not heated.)

Exterior walls in Florida multifamily housing are most often constructed of concrete, but other materials are also used. The available data include stucco and siding, which are exterior cladding commonly applied over concrete block or wood frame walls. The data on wall types are[50]:

- Concrete/Concrete block 30%
- Stucco 30%
- Brick 19%
- Wood 13%
- Siding (Aluminum, Vinyl, or Steel) 8%

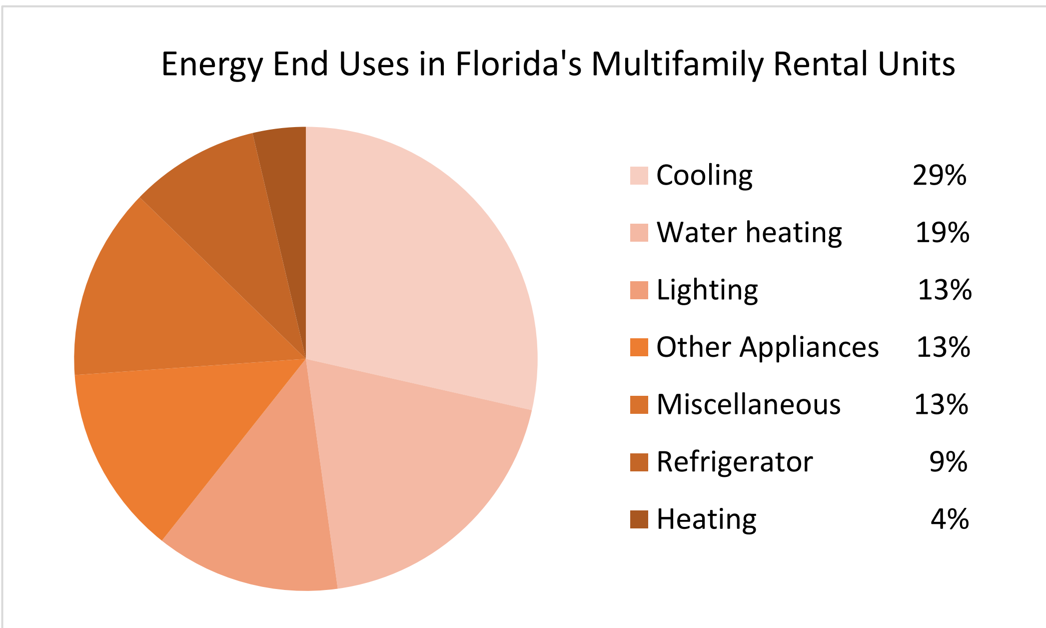
Appliances typically include a refrigerator, electric stove, electric water heater, and electric air conditioning unit. The refrigerator is typically not ENERGY STAR compliant, and is predominantly the only one in the unit (i.e., no second refrigerator or freezer). Approximately half of the units come equipped with a dishwasher,

[50] Energy Information Administration, Residential Energy Conservation Survey Results 2009, http://www.eia.gov/consumption/residential/data/2009/

with half of the dishwashers being used, most of those are used once a week or less. Clothes washers and dryers are paired, with 57% of units having these appliances, which are primarily electric, top loaders less than ten years old, and only 25% of the washers are ENERGY STAR compliant. The typical multifamily unit has two televisions.

Modeling indicates that the average total annual energy use in a typical multifamily unit is about 10,000 kWh, which would cost $1,200 per year, on average. Energy for cooling requires the largest share at 29%. Water heating is the second largest energy need, accounting for 19% of the total. Lighting, other appliances and miscellaneous uses (including electronics) each consume about 13% of typical electric energy. Figure 2-5 and Figure 2-6 illustrate the shares of energy and water consumption, respectively, for different end uses in typical Florida rental apartments.[51] To gain a perspective on the quantities of water used by various indoor fixtures and how their efficiency has improved, monthly household water use is compared for buildings constructed under differing plumbing codes in Figure 2-7. Key characteristics affecting energy and water use efficiency in Florida's rental apartments are summarized in Table 2-4.[52]

Figure 2-5 Florida multifamily rental units' energy end uses



[51] These numbers are derived from FSEC and PREC modeling parameters/assumptions, detailed in Sections 3.2 and 3.3.

[52] Energy Information Administration, Residential Energy Conservation Survey Results 2009, http://www.eia.gov/consumption/residential/data/2009/

Figure 2-6 Florida's multifamily rental units' indoor water end uses

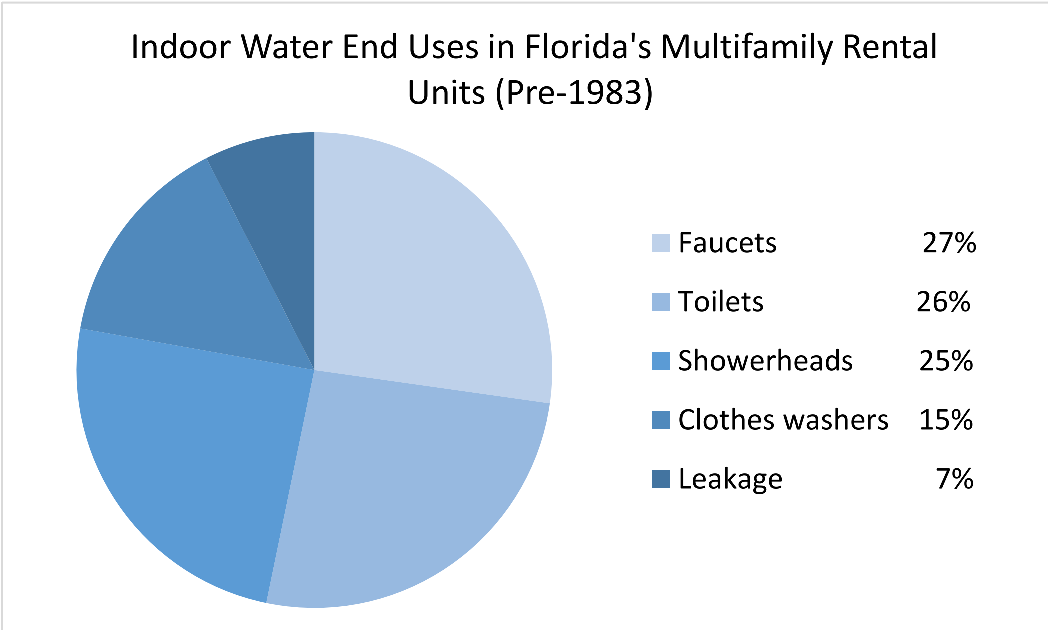


Figure 2-7 Florida's multifamily rental units' indoor water use by building construction date

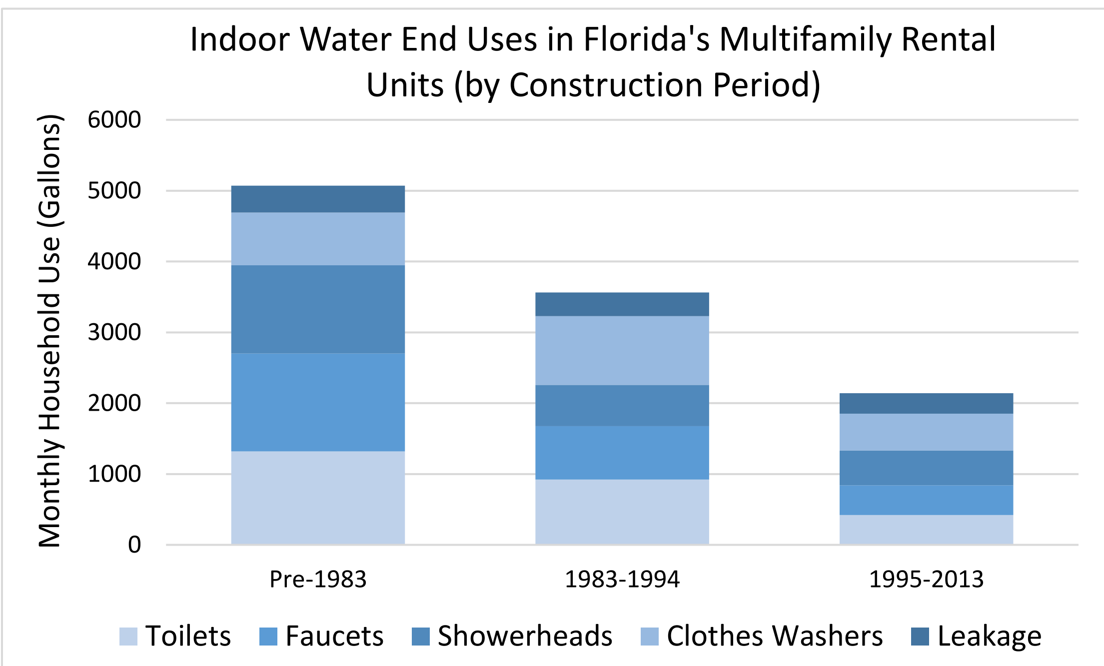


Table 2-4 Average Florida multifamily housing characteristics by number of bedrooms.

Multifamily Housing Characteristics: Number of Bedrooms					
Multifamily rental properties		**1 bedroom**	**2 bedrooms**	**3 or more bedrooms**	**Average / total**
Total occupied number of units (percent of total)[1]		579,491 (44%)	605,433 (46%)	131,902 (10%)	**1,316,825**
Average unit size (square feet of conditioned area)[2]		722	986	1,172	**888**
Average hot water use (gpd)[3]		35	47	59	**43**
Average indoor water use[4]					
Pre 1983:	(gallons per month) ($/month)	3,680 ($17)	5,840 ($21)	8,430 ($28)	**5,150 ($20)**
1984-1994:	(gallons per month) ($/month)	2,590 ($14)	4,110 ($18)	5,930 ($22)	**3,620 ($17)**
1995-2013:	(gallons per month) ($/month)	1,150 ($13)	2,470 ($14)	3,560 ($16)	**2,170 ($14)**
Average electricity use (kWh per month)[3] ($/month)		721 ($94)	873 ($114)	1,040 ($135)	**823 ($107)**

[1]Shimberg data; [2]RECS data; [3]FSEC modeled data; [4]PREC calculations

2.3.3 Housing stock characterization summary

Florida's multifamily rental housing can be characterized by the following important statistics and features:

- There are over 1.3 million rental units in Florida classified as multifamily.
- More than half of all units were built before 1980 when the first energy codes came into effect in Florida (1983 for water efficiency codes), so are less efficient than most other types of housing.
- One and two bedroom apartments make up 90% of the units, in approximately equal numbers, with an average size of almost 900 square feet.
- Almost all units have full kitchens and a single bathroom.
- Electricity consumption is more than 800kWh per month, costing about $100 monthly.
- Cooling and hot water consume the most electricity, followed by equal amounts for lighting, appliances, and miscellaneous (including electronics). Heating requires only four percent of the power consumed, on average.

- Average indoor water use is much higher in older units (more than 5,000 gallons per month) compared to a little more than 2,000 gallons used per month in newer units. This difference is not reflected in the cost of water, which ranges from about $14 per month in newer units to $20 in the oldest apartments.
- Toilets, faucets, and showers all use between 25%–30% of water in older apartments. Clothes washers use about 15% and leakage accounts for approximately 7% in these units. Newer fixtures have a slightly different percentage breakdown, but are much more efficient in overall water consumption.

2.4 Energy savings potential

Energy modeling was used to determine potential energy savings from improving the efficiency of multifamily rental units. First, available compiled data were sought, as detailed in Section 3.1. Second, these data were used to determine typical building characteristics for one, two and three bedroom apartment units. Those building characteristics were used to model energy use with EnergyGauge® USA, a tool used for code compliance and energy ratings. Two retrofit options were developed, one a low-cost “shallow retrofit” and one a “deep retrofit” package that included the shallow measures plus capital-intensive replacements that would likely only be done at times of major renovation. Rough cost estimates and payback times for each of the energy-retrofit packages are presented.

2.4.1 Energy modeling configurations

The multifamily dwellings modeled include one-, two- and three-bedroom units. For “typical” units, we used the architectural characteristics of actual built Florida units that were within 5% of the floor area of the average RECS data. The base refrigerator efficiency was set to match the RECS data as well. There is significant variability in the presence, type and amount of wall and ceiling insulation across existing multifamily properties, and these parameters were conservatively set at R-11 wood frame wall construction and R-19 ceiling insulation. Table 2-5 provides the configurations for the base, shallow retrofit and deep retrofit units with bold font indicating differences across the base to shallow and/or shallow to deep retrofit parameters.

Table 2-5 EnergyGauge base, shallow and deep retrofit modeling configurations.

EnergyGauge® Modeling Configurations			
Parameter	**Configuration**		
	BASE (EXISTING)	**SHALLOW RETROFIT**	**DEEP RETROFIT**
Wall Insulation (frame)	R-11	R-11	R-11
Ceiling Insulation (top floor units)	R-19	**R-38**	R-38
Window U-factor / SHGC	1.2 / 0.8	1.2 / 0.8	**0.3 / 0.25**
HVAC System			
Type: Miami / Tampa / Jacksonville	AC / AC / HP	AC / AC / HP	AC / **HP** / HP
Efficiency: SEER / HSPF	13.0 / 7.7	13.0 / 7.7	**16.0 / 9.0**
Duct Leakage	Default	**Qn_{out} = 0.03**	Qn_{out} = 0.03
High Efficacy Lighting	10%	**80%**	80%
Water Heater			
Type	Electric Tank	Electric Tank	Electric Tank
Efficiency	EF = 0.88	EF = 0.88	EF = 0.88
Capacity (gal): 1 bdrm, 2 bdrm, 3 bdrm	30, 40, 40	30, 40, 40	30, 40, 40
Use (gal/day): 1 bdrm, 2 bdrm, 3 bdrm	35, 47, 59	**Low*: 27, 36, 45**	Low*: 27, 36, 45
Tank wrap	No	**Yes, R-3**	Yes, R-3
Refrigerator	997 kWh/y (Std.)	997 kWh/y (Std.)	**383 kWh/y (EStar)**

* Low = low flow shower heads and faucets.

2.4.2 Energy modeling results

EnergyGauge USA modeling results are provided in Table 2-6 for the one, two and three bedroom units respectively. A "top unit" is a unit that has unconditioned attic space above the ceiling and another unit below it. A "middle unit" is a unit that has other units both below and above it.

The tables show base annual energy use together with annual energy use and savings for shallow and deep retrofits (as outlined in Table 6) for Miami, Tampa and Jacksonville. Shallow retrofit savings are relatively consistent for all unit sizes and locations, ranging from 13.2% to 16.3%, with the higher savings being realized for the top units with the improved ceiling insulation. Deep retrofit energy savings are also relatively consistent, ranging from 28.3% to 33.2%, with the higher savings again being realized for the top units.

Actual savings will of course vary depending on how close a given unit's efficiency is to the base efficiency assumed for these modeling runs. A unit with an older or mismatched AC system will see greater savings than estimated here when this system is replaced with the high efficiency system. Similarly, a top unit with poor ceiling insulation or very leaky duct work will also see greater savings from the respective improvements than estimated. While some base units will conversely be more efficient than assumed here, it is anticipated that the savings shown in Table 2-6 are relatively conservative. In some homes with very leaky ductwork or top units with total gaps in ceiling insulation, running the air conditioner may have been unaffordable. In those cases, improving the home may increase energy use as the renters will be able to afford comfort unachievable prior to the retrofit. A stakeholder interviewed for this study noted that the former was indeed the case in several affordable housing units retrofit as part of a Weatherization Assistance Program (WAP) project in North Florida, but the latter was not. Prior to the WAP retrofits, several tenants reported that they could not afford to run their air conditioning systems. After new HVAC systems were installed, not only were they able to cool their homes, but their energy bills also dropped by 30% or more (as verified by an independent post-retrofit billing analysis).[53]

> *"While deep retrofits provide significantly higher energy savings, they are likely only cost effective at the time of replacement.*

The shallow retrofits shown are considered relatively simple and cost-effective options for a large number of Florida multifamily buildings. Each shallow improvement listed in Table 2-5 will also stand on its own, so for example, if a given building already has tank wrap and low flow fixtures, performing the remaining measures (ceiling insulation upgrade, duct sealing and lighting improvements) should still be cost effective.

While the deep retrofits provide significantly higher energy savings, they are likely only cost effective at the time of replacement (e.g. the SEER 16.0 / HSPF 9.0 heat pump retrofit would only be a cost-effective option if a unit must be replaced or in the case of very old existing equipment). The refrigerator improvement represents large savings. Most of those savings occur due to replacing an older unit with a new unit that has to meet federal standards. Selecting an ENERGY STAR unit provides an additional minimum of 9 to 10% savings for the same type of unit. Standards and energy use vary by type and size of refrigerator. Typically, the lower cost freezer-above-single-door refrigerators without ice-makers use less energy than other types.

[53] Stakeholder interview with a representative of the St. Johns Housing Partnership (SJHP) on November 5, 2014.

Table 2-6 EnergyGauge USA modeling results for 1-bedroom, 2-bedroom and 3-bedroom unit retrofits.

EnergyGauge Modeling Results										
Size	**Top Unit Energy Use (kWh/yr)**					**Middle Unit Energy Use (kWh/yr)**				
	BASE	**SHALLOW**	**SAVINGS**	**DEEP**	**SAVINGS**	**BASE**	**SHALLOW**	**SAVINGS**	**DEEP**	**SAVINGS**
1 Bedroom (759 sq. ft.)										
Miami	9,418	7,941	15.7%	6,343	[illegible]	8,763	7,561	13.7%	6,086	30.5%
Tampa	9,414	7,952	15.5%	6,285	[illegible]	8,657	7,516	13.2%	5,988	30.8%
Jacksonville	9,040	7,616	15.8%	6,284	[illegible]	8,414	7,276	13.5%	5,993	28.8%
2 Bedroom (993 sq. ft.)										
Miami	11,462	9,610	16.2%	7,846	[illegible]	10,573	9,099	13.9%	7,427	29.8%
Tampa	11,514	9,673	16.0%	7,690	[illegible]	10,481	9,082	13.3%	7,293	30.4%
Jacksonville	11,010	9,214	16.3%	7,682	[illegible]	10,167	8,752	13.9%	7,294	28.3%
3 Bedroom (1198 sq. ft.)										
Miami	13,054	11,098	15.0%	9,031	[illegible]	12,557	10,811	13.9%	8,803	29.9%
Tampa	13,065	11,148	14.7%	8,853	[illegible]	12,474	10,810	13.3%	8,628	30.8%
Jacksonville	12,494	10,588	15.3%	8,840	[illegible]	12,033	10,344	14.0%	8,614	28.4%

2.4.3 Energy improvement measure costs

Table 2-7 presents estimated costs for each of the upgrades and sums the values for the total package. The shallow retrofits are expected to be done by a low-cost laborer at $25 per hour with the exception of the duct leakage which would have a higher rate. The shallow retrofits would save about $168 to $221 on a two-bedroom unit and have a payback of 3.5 years for most units. The ceiling insulation measure, here assumed to be added to an effective R-19, brings the payback of top floor units to five years. However, as mentioned above, in reality there are likely issues with the current insulation and blowing in additional insulation to achieve R-19 may save more than our estimate reducing payback from our conservative estimate.

Deep retrofits are full replacement of expensive items –windows, HVAC and refrigerators. If they were to be replaced just for the purpose of energy efficiency they are not cost effective. If they need to be replaced anyhow then efficient units could be chosen cost effectively. ENERGY STAR refrigerators can be found at about the same cost as base models. The window upgrade shown is minimum 2014 Florida energy code level. The SEER 16 heat pump may cost an extra $1000 over the base level. New standards going into effect January 1, 2015 will raise the minimum level installed to SEER 14, reducing the upgrade difference from the current SEER 13 level. The overall payback for the upgrades in the deep package would be less than five years if done at time of replacement.

Table 2-7 Estimated costs for energy improvement measures.

Estimated Costs for Energy Improvement Measures						
Parameter	Modeling Configurations for a 2 bedroom 993 sq. ft. unit					
	BASE	SHALLOW RETROFIT		DEEP RETROFIT		
		Improvement	Estimated Cost	Improvement	Estimated Full Replacement Cost	Upgrade to efficient level when replacing
Ceiling Insulation (top floor units)	R-19	**R-38**	$500	R-38		
Window U-factor / SHGC	1.2 / 0.8	1.2 / 0.8		**0.3 / 0.25**	**$2,000**	**NA**
HVAC System						
Type: Miami / Tampa / Jacksonville	AC / AC / HP	AC / AC / HP		AC / **HP** / HP		
Efficiency: SEER / HSPF	13.0 / 7.7	13.0 / 7.7		**16.0 / 9.0**	$6,000	$1,000
Duct Leakage	Default	**Qn_{out} = 0.03**	$300	Qn_{out} = 0.03		
High Efficacy Lighting	10%	**80%**	$150	80%		
Water Heater						
Type	Electric Tank	Electric Tank		Electric Tank		
Efficiency	EF = 0.88	EF = 0.88		EF = 0.88		
Capacity (gal): 1 bdrm, 2 bdrm, 3 bdrm	30, 40, 40	30, 40, 40		30, 40, 40		
Use (gal/day): 1 bdrm, 2 bdrm, 3 bdrm	35, 47, 59	**Low*: 27, 36, 45**	$100	Low*: 27, 36, 45		
Tank wrap	No	**Yes, R-3**	$50	Yes, R-3		
Refrigerator	997 kWh/y (Std.)	997 kWh/y (Std.)		**383 kWh/y (EStar)**	**$550**	**$10**
Total Cost (top floor)			**$1,100**		**$8,550**	**$1,010**
Savings (Tampa) at $0.12/kWh			**$221**		**$238**	**$238**
Total Cost (other floors)			**$600**		**$8,550**	**$1,010**
Savings (Tampa) at $0.12/kWh			**$168**		**$215**	**$215**
Payback -yrs			**3.6–5**		**36–40**	**4.2–4.7**

* Low = low flow shower heads and faucets.

2.5 Water savings potential

This section follows methods consistent with those used in the energy savings analysis to estimate the water savings potential from retrofits to Florida's typical multifamily rental units and, unless otherwise noted, reference U.S. Census ACS data.

2.5.1 Water modeling assumptions

Most water use in rental properties is for indoor consumption. Outdoor irrigation of common areas may be metered separately and generally makes up a relatively small component of total water use in apartment complexes of five or more units.

The major end uses of indoor water, toilets, showers, faucets, and washing machines have been shown to be fairly consistent for homes or apartments: they are largely a function of the number of persons using them and the design capacity of the fixture or appliance. Water usage can be predicted by the average number of occupants and the design code in effect at the time of building construction. Although some multifamily units have dishwashers, as previously mentioned, the RECS data indicate that they are not frequently used, so they are not considered for typical retrofits and are not included in this analysis.

Historically, the largest share of indoor water is used to flush toilets. Prior to 1983, most toilets consumed five gallons of water per flush. Between 1983 and 1994, codes required 3.5 gallon per flush toilets, and since 1995, the standard has been 1.6 gallons per flush. Newer low-flow toilets using 1.28 gallons or less are gaining in popularity, but are not universally used in toilet retrofit programs.

Several types of inexpensive toilet retrofit devices have been used to reduce the volume of water used by older toilets. Some displace a portion of the water held in the tank (the old "put a brick in your tank" concept); others employ early-closing flappers which close to prevent the tank from completely emptying during a flush, or conversion kits to add a dual-flush capability to provide a low volume option to standard toilets. These devices can be highly cost effective, but if the toilet does not function well (having been designed for a larger flush volume), the retrofit can backfire and increase the total volume of water if the occupant is required to double flush. At best, these are considered temporary measures and not reliable means of reducing water consumption.[54] Utilities want a more permanent solution if they are going to invest in retrofit programs.[55]

In the analysis of potential water savings below, the average number of persons per apartment (1.9) and the average number of toilets per apartment (1.0) were assumed to be the same, regardless of the age of the building.[56]

Toilets: Toilet water consumption is calculated based on 5.1 flushes per day for each occupant, regardless of the number of toilets in each apartment.

Faucets: Apartments were assumed to have lavatory faucets in each bathroom and a kitchen sink, for an average of two faucets per unit. Each person was assumed to use a faucet for 8.1 minutes per day.[57]

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54 Alliance for Water Efficiency, Toilet Retrofit Devices Introduction, 2010, http://www.allianceforwaterefficiency.org/1Column.aspx?id=2146&LangType=1033&terms=retrofit

55 Stakeholder interview with a Senior Environmental Engineer at a municipal Florida utility. November 10, 2014.

56 Data selected and summarized from: US Census, American Community Survey, downloadable Public Use Microdata Sample (PUMS) Files, File acs2013_1yr/, 23-Oct-2014 07:48, http://www2.census.gov/

57 *Ibid.*

Showerheads: Multifamily rental units in Florida average 1.0 bathrooms[58], and each was assumed to have a shower. Typical duration of showers has been found to be 8 minutes and occupants take an average of 0.7 showers per person per day.[59]

Clothes Washers: This analysis assumed that all clothes washers built prior to 1983 have already been replaced and that households average 0.37 loads of laundry per day[60] or 257 loads per year.

Indoor Leakage: Water leakage is a surprisingly large component of indoor water use, ranging from about 8 to 18 percent in a typical unit.[61] Improper seals of toilet flappers or delayed closing of the toilet valve are most common, followed by dripping faucets. Other leaks may occur in difficult-to-access piping. Because new leaks may develop at any time, it is not appropriate to assume that all leakage can be eliminated; therefore, for this analysis, shallow and deep retrofits were assumed to correct 50% – 75% of water leakage respectively.

Retrofits: Shallow retrofits were assumed to include replacement of all pre-1995 faucet aerators and showerheads to meet current code, and replacement of all pre-1983 toilets with 1.28 gallons per flush WaterSense models, as well as repairing simple fixture leaks. Deep retrofits also replace faucet aerators and showerheads and replace older toilets with 0.8 gallon-per-flush models. Deep retrofits also include ENERGY STAR clothes washer replacements and repair of some additional plumbing leaks. Table 2-8 provides a summary of existing water usage by age of fixtures and the assumed replacements included in shallow and deep retrofit packages.

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58 *Ibid.*

59 Friedman, K. 2009. Evaluation of Indoor Urban Water Use and Water Loss Management as Conservation Options in Florida. M.E. Thesis, Dept. of Environmental Engineering Sciences, U. of Florida, Gainesville, FL. page 100, http://www.conservefloridawater.org/publications/5022355.pdf

60 *Ibid*, page 101.

61 *Ibid,* page 101.

Table 2-8 Water conservation measures: base, shallow and deep retrofit modeling configurations.

Water Usage by Type and Age of Fixtures; Retrofit Assumptions					
Parameter	**Configuration**				
	BASE (EXISTING)			**SHALLOW RETROFIT**	**DEEP RETROFIT**
	Pre 1983	**1983-1994**	**1995-2013**		
Toilets					
Fixture (gallons per flush):	5	3.5	1.6	**1.28**	**0.8**
Avg. household daily (gpd):	48	34	16	**12.4**	**7.8**
Showerheads					
Flow rate (gpm):	4.3	2.0	1.7	**1.7**	**1.7**
Avg. household daily (gpd):	46	21	18	**18**	**18**
Faucets					
Flow rate (gpm):	3.3	1.8	1.0	**1.0**	**1.0**
Avg. household daily (gpd):	51	28	15	**15**	**15**
Clothes Washers[1]					
Each (gallons per load):	—	51	27	—	**15**
Avg. household daily (gpd):	—	36	19	—	**10.5**
Indoor Water Leakage[2]					
Loss Rate (gpcd):	12.5	11.0	9.5	**50% reduction**	**75% reduction**
Losses (gpd):	24	21	18	**12 / 10.5 / 9**	**5.9 / 5.2 / 4.5**

1 All pre-1983 clothes washers are assumed to have been replaced with equal numbers of machines from the other time periods.

2 Households are assumed to have 1.9 persons; shallow and deep retrofits are assumed to eliminate 50% and 75% of leaks, respectively.

2.5.2 Water modeling results

Toilets: The greatest potential volume of water savings are gained by replacement of all pre-1983 toilets. New WaterSense toilets using 1.28 or 0.8 gallons per flush could save 36 – 41 gallons each day respectively for an average apartment, totaling approximately 13,000 – 15,000 gallons per year for each retrofit toilet.

Faucets and Showerheads: Because replacement of low flow showerheads and faucet aerators is so inexpensive, they should be included in every retrofit undertaken, whether the focus of the retrofit is water or energy conservation. The payback period for these measures will be less than a year for all older fixtures. These measures are considered part of shallow and deep retrofit water efficiency packages, and can be included as part of walk-through audits.

Clothes Washers: Approximately 57% of Florida apartments are estimated to have washing machines, and only 14% of units currently have an ENERGY STAR washing machine.[62] Many other apartment buildings have laundry rooms on the premises. Building owners may have a greater incentive to replace washing machines with efficient units as they pay for both water and energy. Because central unit washing machines are used

62 Energy Information Administration, Residential Energy Conservation Survey Results 2009, http://www.eia.gov/consumption/residential/data/2009/, final release date May 2013.

by multiple tenants, the economics for replacement of inefficient machines are better than for those in individual units. Average use for common laundry room machines was estimated at 1,246 loads per year. [63] Current standard machines use about 27 gallons per load and new ENERGY STAR machines use only 15 gallons per load. Savings of 36 gallons per load are possible from replacing pre-1994 machines, adding up to cumulative savings for an average household of about 9,200 gallons per year. Savings in common laundry rooms could add up to about 37,000 gallons per year per washing machine changed out. These should be given a priority for replacement in older apartment buildings.

Indoor Leakage: Leaks from improper flushing mechanisms in toilets and dripping faucets are simple to repair for apartment maintenance staff. Simply checking all faucets and toilets (that are not being replaced) for leaks and repairing as necessary will always make economic sense and should be included in shallow retrofits. Leaks in piping are more difficult and costly, but some of these repairs may be done with deep retrofits. Shallow and deep retrofits were assumed to correct 50% – 75% of water leakage respectively.

> *"Because replacement of low flow showerheads and faucet aerators is so inexpensive, they should be included in every retrofit undertaken, whether the focus of the retrofit is water or energy conservation.*

As illustrated by the retrofit summaries in Table 2-9, substantial water savings could be realized by targeting rental apartments constructed before 1983: reductions of about 57% are possible with shallow retrofits and reductions of up to 66% could be expected from deep retrofit of buildings with all older fixtures. Of course some buildings may have replaced a portion of their old fixtures, and if so, their total savings would be proportionally less. Also, the number of persons occupying each unit will affect the actual savings realized, with fewer persons per unit having lower savings and larger numbers per unit expecting greater savings.

The majority (52%) of rental multifamily housing in Florida was constructed before 1983 (Table 2-10)[64], offering a significant opportunity for sizeable, cost-effective retrofits. The costs of water retrofits, shown in Table 2-11, range from $44 for an audit-level retrofit (with a payback of less than three months) to $344 for a shallow retrofit (with a payback of one year) and $1,144 for a deep retrofit (with a payback of 2.9 years).

[63] Department of Energy. 2010. "Energy Conservation Program: Energy Conservation Standards for Certain Consumer Products (Dishwashers, Dehumidifiers, Microwave Ovens, and Electric and Gas Kitchen Ranges and Ovens) and for certain commercial and industrial equipment (Commercial Clothes Washers), Final Rule." Federal Register. 10 CFR Parts 429 and 430.

[64] Adapted from data provided by Anne Ray, University of Florida Shimberg Center for Housing Studies.

Table 2-9 Water savings potential from shallow and deep retrofits

Water Savings Potential from Retrofits							
Household Indoor Water Use		Shallow Retrofit			Deep Retrofit		
Measure	Base Use (Gallons/yr)	Use (Gallons/yr)	Savings (Gallons/yr)	Savings %	Use (Gallons/yr)	Savings (Gallons/yr)	Savings %
Toilets							
Pre-1983	15,823	4,052	11,771	74%	2,533	13,290	84%
1983-1994	11,076	4,052	7,024	63%	2,533	8,543	77%
1995-2013	5,063	4,052	1,011	20%	2,533	2,529	50%
Showerheads							
Pre-1983	14,943	5,906	9,037	60%	5,906	9,037	60%
1983-1994	6,950	5,906	1,044	15%	5,906	1,044	15%
1995-2013	5,906	5,906	—	—	5,906	—	—
Faucets							
Pre-1983	16,571	5,037	11,534	70%	5,037	11,534	70%
1983-1994	9,052	5,037	4,015	44%	5,037	4,015	44%
1995-2013	5,037	5,037	—	—	5,037	—	—
Clothes Washers[1]							
Pre-1983	8,943	8,943	—	—	6,205	2,738	31%
1983-1994	11,680	11,680	—	—	6,205	5,475	47%
1995-2013	6,205	6,205	—	—	6,205	—	—
Leakage							
Pre-1983	4,563	2,281	50% repaired	50%	3,422	75% repaired	75%
1983-1994	4,015	2,008	50% repaired	50%	3,011	75% repaired	75%
1995-2013	3,468	1,734	50% repaired	50%	2,601	75% repaired	75%
Complete Water Retrofit Package							
Pre-1983	**60,842**	**26,218**	**34,624**	**57%**	**20,821**	**40,020**	**66%**
1983-1994	**42,773**	**28,682**	**14,091**	**33%**	**20,685**	**22,088**	**52%**
1995-2013	**25,678**	**22,933**	**2,745**	**11%**	**20,548**	**5,130**	**20%**

[1] Assumes that all pre-1980 washing machines have been replaced, with models equally from the other time periods. Retrofit machines meet current ENERGY STAR specifications.

Table 2-10 Florida multifamily rental housing by construction date matched with plumbing codes.

Multifamily Rental Housing by Construction Date Matched with Plumbing Code			
Year building constructed	**Pre 1983**	**1983-1994**	**1995-2013**
Percent of Multifamily Rental Units	52%	19%	29%
Number of Multifamily Rental Units	685,487	251,780	379,558

Table 2-11 Costs of water retrofits

Typical Cost of Fixtures for Water Retrofits[65]			
Parameter	**Audit Level**	**Shallow Retrofit**	**Deep Retrofit**
High Efficiency Toilet	—	$300	$300
Low Flow Showerhead	$40	$40	$40
Low Flow Faucet Aerators	$4	$4	$4
ENERGY STAR® Washing Machine	—	—	$800
Total Cost for Retrofit	**$44**	**$344**	**$1,144**
Savings (gallons per year)	**20,500**	**34,624**	**40,020**
Savings at $0.01/gallon	**$205**	**$346**	**$400**
Payback – yrs	**0.2**	**1.0**	**2.9**

2.6 Summary and scaled savings potential

Florida's building stock, energy and water use patterns and tenant characteristics differ from "typical multifamily rental" characterizations provided by national studies. Evaluating locally-relevant information—historical consumption data, household demographics and building stock features—is important to generate more realistic estimates of the savings potential in Florida's multifamily rental housing. This section summarizes results of the Florida-specific energy and water savings potentials.

2.6.1 Energy savings potential summary

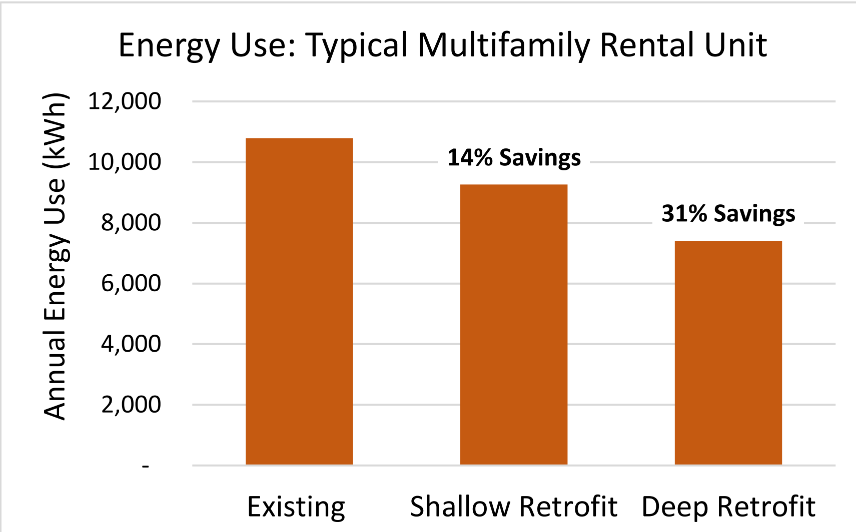
Shallow energy retrofits (as defined in Section 2.4.1) to a typical two-bedroom apartment in Tampa (993 square feet in size) would generate annual electricity savings of 1,533 kWh (14% of base use) and deep retrofits would generate savings of 3,382 kWh (31% of base use). These results are summarized in Figure 2-8. Assuming an avoided cost of $0.12 per kWh[66], shallow retrofits would lead to annual electric bill savings

65 Homewyse, 2014, http://www.homewyse.com/costs/cost_of_high_efficiency_toilets.html. Accessed January 2015.

66 This assumption is based on a Florida Municipal Electric Association (FMEA) residential bill comparison across Florida's electric utilities: in November 2014, the investor-owned utilities' average rate was $0.126/kWh and the municipal utilities' average rate was $0.120/kwh. http://www.publicpower.com/pdf/rates/2014/2014_november_rates.pdf Accessed January 8, 2015.

of $184 per unit and deep retrofits to annual savings of $406 per unit. If shallow energy retrofits were applied to 10% of the apartments in the state (about 132,000 units), total savings would exceed 201 GWh per year. Deep retrofits of the same number of units would yield total savings in excess of 445 GWh: enough to meet the electricity needs of over 43,000 homes for one year.[67]

Figure 2-8 Energy retrofit summary results



2.6.2 Water savings potential summary

Shallow water retrofits (as defined in Section 2.5.1) to each typical rental unit constructed prior to 1983 would save 34,624 gallons per year (57% of base use) and deep retrofits would save 40,020 gallons per year (66% of base use). These results are summarized in Figure 2-9. Assuming an avoided water and wastewater cost of $0.01 per gallon[68], these efficiency improvements equate to annual water bill savings of $346 per unit for shallow retrofits and $400 per unit for deep retrofits to pre-1983 apartments. If shallow water retrofits are performed on 10% of all multifamily rental units in Florida constructed during this period (about 68,500 units), total savings would exceed 0.95 million gallons per day (MGD). Significant savings could be achieved from replacing faucet aerators and showerheads on pre-1983 fixtures, simple change-outs that are possible to complete during a walk-through audit. These measures alone could save up to 20,000 gallons per year for each retrofit unit. Deep retrofits to 10% of units constructed prior to 1983 could yield total water savings of 7.5 MGD: enough water to fill over 4,000 Olympic-sized swimming pools or meet the indoor water needs of over 100,000 households living in new (built since 1995) apartments.

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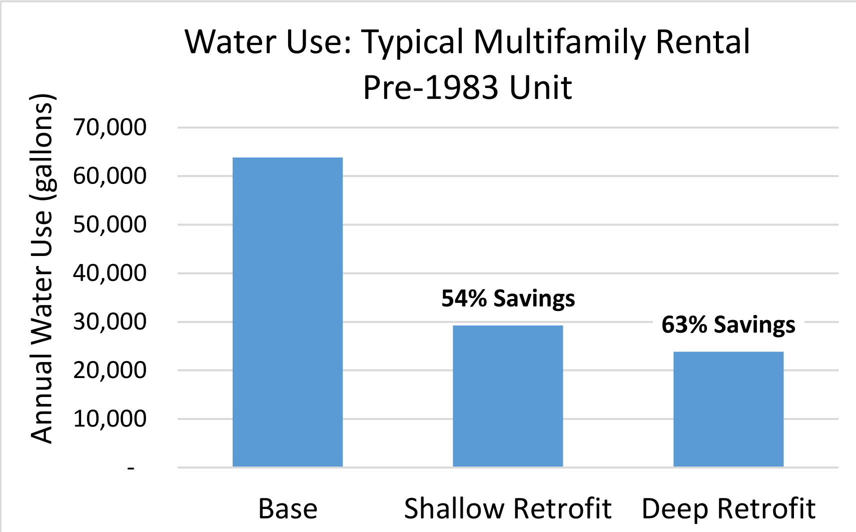
67 Based on conversion using the U.S. EPA's Greenhouse Gas Equivalency Calculator, http://www.epa.gov/cleanenergy/energy-resources/calculator.html. Accessed January 2015.

68 This assumption is based on a calculated average water and wastewater rate of $0.011 per gallon across a sample of nine Florida water utilities: Miami-Dade Water and Sewer Department 2014-2015 Residential Water Rate Comparison, http://www.miamidade.gov/water/rates.asp. Accessed January 8, 2015.

Figure 2-9 Water retrofit summary results



2.6.3 Combined energy and water retrofits

Utility bill savings for typical units: At an avoided electricity cost of $0.12 per kWh and avoided water and wastewater cost of $0.01 per gallon, combined annual energy and water shallow retrofit savings are estimated at $530, $325 and $211 respectively for individual pre-1983, 1983-1994 and 1995-2013 two-bedroom units in Tampa. Combined annual energy and water deep retrofit savings are estimated at $806, $627 and $457 respectively for the same units.

Scaled savings for large projects: Based on these modeled energy and water savings potentials and depending on the age of the units and level of retrofit, a 10,000 unit efficiency retrofit project could yield total annual savings of between $2.1 million and $8.1 million. Alternatively, shallow retrofits performed on 10% of all multifamily rental housing in the state (about 132,000 units) would provide an estimated $52.5 million in annual savings while deep retrofits would provide $88.3 million in annual savings.

> *"A 10,000 unit energy and water efficiency retrofit project could yield total annual savings of between $2.1 million and $8.1*

Statewide scaled savings: If applied to the 1.3 million multifamily rental units in Florida, combined energy and water efficiency retrofits could lead to annual energy savings of 3,286 GWh and water savings of 87.7 million gallons per day (MGD). This scenario assumes shallow retrofits to newer units (those built since 1983) and deep retrofits to older units (those built prior to 1983). Efficiency improvements of this scale could save Florida's multifamily property owners and renters an estimated $714 million in annual utility bills.

3. Efficiency Program Cost Effectiveness

This section explores characteristics of efficiency programs that drive their overall cost effectiveness.

3.1 Efficacy of audits

Common barriers to audits and retrofits include[69]: consumer inertia, limited access to capital, lack of awareness by the public, and unavailability of home performance services. A recent survey[70] of the efficacy of energy audits shows that not all home and business owners are aware of audits. Because audits are "purely informational," the efficiency gains are only realized if the owners follow up and implement the recommended improvements or install the provided WaterSense (high efficiency) shower heads or CFL lights. The survey results suggest that it is rare for customers to follow up on all of the auditor's recommendations for improvement. The authors of the survey also find that the expense associated with retrofits and low electricity prices may be more responsible for the lack of energy efficiency than reasons relating to lack of information.

The main recommendations from auditors surveyed to increase home energy efficiency are: (1) Higher price for energy (2) More government rebates/subsidies (3) Better understanding/awareness of audits. The same study included comments by auditors themselves on how to increase the adoption of energy-efficient improvements by homeowners. The auditors' recommendations include: increasing awareness and information availability, better defining the industry/creating standards, and having the government make audits a requirement either when a house is sold or when a mortgage is secured.

Another important aspect is energy audit participation rates. A review[71] of 85 programs found an average annual participation rate of 3.2%. The 1980-1992 Bonneville Power Administration program[72] stands out as a very successful program with a participation rate of 56% over a 12 year period. This program offered: "free audits, 85% rebates for energy improvement, and 0% interest on loans."[73] A different study[74] examined energy audits for industrial customers and found that, even though once again only a portion of the recommendations were adopted, most customers did respond to the costs and benefits presented in audits, suggesting that information generated from the audits is important.

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69 Home Performance Resource Center. (2010a). Best practices for energy retrofit design: financing and incentives recommendations. Washington, DC. Cited in Palmer et al. 2013.

70 Palmer, Karen, Margaret Walls, Hal Gordon, and Todd Gerarden. 2013 Assessing the energy efficiency information gap: results from a survey of home energy auditors. *Energy Efficiency* 6:271–292.

71 Berry, L. (1993). A review of the market penetration of U.S. residential and commercial demand-side management programmes. Energy Policy, 21(1), 53–67. Cited in Palmer et al. 2013.

72 Fuller, M., Kunkel, C., Zimring, M., Hoffman, I., Soroye, K. L., & Goldman, C. (2010). Driving demand for home energy improvements: motivating residential customers to invest in comprehensive upgrades that eliminate energy waste, avoid high bills, and spur the economy. Report LBNL-3960E. Berkeley: Lawrence Berkeley National Laboratory, Environmental Energy Technologies Division. Cited in Palmer et al. 2013.

73 Palmer, Karen, Margaret Walls, Hal Gordon, and Todd Gerarden. 2013. Page 273. Assessing the energy efficiency information gap: results from a survey of home energy auditors. *Energy Efficiency* 6:271–292.

74 Anderson, S. and R.Newell. 2004. Information programs for technology adoption: the case of energy-efficient audits. Resource and Energy Economics. 26:27-50. Cited in Gillingham, Newell, and Palmer (2009).

3.2 Data availability, transparency and access

According to the U.S. Department of Housing and Urban Development[75], one of the issues with investment in energy efficiency measures in multifamily housing stems from a lack of data on payback periods for retrofits. This is because, even though there are data on multifamily markets, multifamily markets are very diverse, so data from one project may not be broadly applied to other market segments. This problem could be partially addressed by incentives for data availability on electricity and water usage. Energy consumption evaluations are likely to be more detailed and site specific if before and after retrofits there is free access to data on electricity and water usage.

In order to accurately gauge the effectiveness of energy efficiency measures, some initiatives, such as HUD's Green Retrofit program, have required owners to allow energy audits before and after the retrofits take place as a condition for receiving funds. This type of analysis often includes the creation of benchmarks for expected energy savings.

> *"Owners and managers of buildings tend to lack data on energy use that would allow them to make decisions about energy efficiency improvements. Data availability regarding building performance allows for the widespread use of benchmarking, which can provide important information for tenants, owners, and policymakers.*

Owners and managers of buildings tend to lack data on energy use that would allow them to make decisions about energy efficiency improvements.[76] This is because utilities usually do not provide aggregated tenant data to the building owners: "There are no neutral data aggregators that can combine data from multiple sources and data-sharing agreements to facilitate the provision of whole-building data".[77] Data availability regarding building performance allows for the widespread use of benchmarking. Comparisons between similar buildings and of the same buildings over time can provide important information for tenants, owners, and policymakers. In New York City, multifamily buildings with more than 50,000 square feet are required to submit benchmarking reports.[78] Minneapolis started a requirement for large building owners in 2014.[79] The owners are required to submit their data to the city which in turn intends to make the data publicly available through a web-based tool. Data availability and access can raise privacy concerns, depending on the level of aggregation that these publicly available reports contain, but the availability of this data is crucial for measuring energy efficiency improvements. An added benefit can be obtained if consumers use this information to compare their consumption to that of their neighbors and change their behavior as a result. As of 2013, the following cities had benchmarking and disclosure policies for large multifamily buildings: Austin, Boston, Chicago, Washington, New York, and Seattle.[80]

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75 U.S. Department of Housing and Urban Development. Evidence Matters. Summer 2011.

76 Energy Programs Consortium. 2013. Multifamily energy efficiency: What We Know and What's Next.

77 *Ibid.* Page 10.

78 Bell, C., S. Sienkowski, S. Kwatra. 2013. Financing for Multi-Tenant Building Efficiency: Why this Market is Underserved and what can be done to reach it. AEEE, Report No. E13E.

79 Haugen, Dan. 2013. Multi-Tenant Building Efficiency Unlocked with Better Energy Data. Midwest Energy News, December 13, 2013.

80 Institute for Market Transformation 2013. BuildingRating.Org U.S. Commercial Benchmarking Policy Comparison Matrix. Available at http://www.buildingrating.org/content/policy-comparison. Cited in Johnson, Kate. 2013. Apartment Hunters: Programs searching for energy savings in multifamily buildings. AEEE Report No. E13N.

3.3 Cost-benefit analysis of Florida's efficiency programs

From an economics perspective, energy and water efficiency improvements can be measured using cost benefit analysis. Cost benefit analysis of efficiency consists of comparing the total system costs of activities that save energy or water to the total benefits, taking into account the expected lifetime values.[81] A program is considered to be economically justified when the benefits exceed the costs. The cost effectiveness of a program will vary depending on the perspective from which the analysis is done. For this reason, there are several tests used to measure the effectiveness of demand side management programs (Table 3-1).[82]

The Rate Impact Measure (RIM) test and the Total Resource Cost (TRC) test are most commonly used by utility regulators. The RIM test examines customer rates. In general, if the utility's revenues rise compared to costs, the rates are expected to fall. For instance, by having energy efficiency programs, utilities can avoid expenses that arise from having to increase the amount of electricity they supply to homes. These expenses can include the costs associated with building a new power plant, electricity transmission, and distribution. Utilities can also incur additional costs by having to administer demand side management programs and providing incentives to customers. Additionally, utilities face revenue reductions due to decreased demand. A program is considered cost-effective under the RIM test if the utility rate does not increase after the introduction of a demand side management program.

The TRC test consists of measuring the net costs incurred by both the participants and the utility. Net costs are defined as being the difference between the benefits and costs of a program. Sample benefits include the utility's avoided expenses to supply capacity expansion, while sample costs include the costs of equipment. This test can be carried out using net present value (NPV) and cost benefit ratios. For example[83], suppose a utility spends $0.02/kWh in rebates for energy-efficient lamps and a customer invests $0.03/kWh for switching to these efficient lamps. Total costs for this program would be $0.05/kWh. This program would pass the Total Resource Cost Test if the overall benefit exceeded $0.05/kWh.

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[81] Bhattacharyya, Subhes describes these tests in detail. Energy Economics: Concepts, Issues, Markets and Governance. 2011. Springer: UK.

[82] Florida Public Service Commission. (2012). "Annual Report on Activities Pursuant to the Florida Energy Efficiency & Conservation Act". Cited by Galligan et al. 2012. Evaluation of Florida's energy efficiency and conservation act.

[83] This example is taken from Swisher, J.N., G.M. Jannuzzi, and R.Y. Redlinger. 1997. *Tools and Methods for Integrated Resource Planning: Improving Energy Efficiency and Protecting the Environment*. UCCEE, Riso. Cited in Bhattacharyya (2011).

Table 3-1 Summary of cost-effectiveness test costs and benefits.[84]

Florida Utility Program Cost-Effectiveness Tests			
	Participant Test	**Total Resource Cost (TRC)**	**Rate Impact Measure (RIM)**
Benefits	Bill savings	Avoided generation	Avoided generation
	Incentives	Avoided distribution	Avoided distribution
	Tax credits	Net system fuel	Net system fuel
Costs	Measure cost	Equipment	Equipment
		Administrative	Administrative
		Measure cost	Incentives
			Lost revenue

Several issues[85] can arise when the benefits and costs of energy and water efficiency policies are measured. The most commonly cited criticism is how to account for "free riders." Free riders in this context are defined as customers who would have invested in efficiency measures in the absence of a policy, but who receive additional benefits from the policy.[86] The costs from these free riders need to be taken into account. There is, however, the possibility of what could be an offsetting effect to "free riders" known as "free drivers." Free drivers[87] arise when customers who are not participating in a program are induced to invest in efficiency as a result of observing program participants.

Another criticism has to do with accounting for the "rebound effect." The rebound effect occurs when efficiency improvements reduce the marginal cost of services, leading to an increase in demand. The end result is a less-than-proportional reduction in energy or water use. For energy efficiency standards, the rebound effect does not seem to be a big problem, in the sense that the empirical evidence points to a numerically small effect.[88] Another commonly cited problem is the use of observational data to estimate energy or water savings. Doing so can be problematic because of the lack of information on what "could

84 Adapted from Galligan et al. 2012. Evaluation of Florida's Energy Efficiency and Conservation Act, Figure 1-1 "Summary of Cost-Effectiveness Test Components," Page 7, citing Florida Public Service Commission. (2012). "Annual Report on Activities Pursuant to the Florida Energy Efficiency & Conservation Act". http://warrington.ufl.edu/centers/purc/docs/FEECA_FinalReport2012.pdf. Accessed November 20, 2014.

85 This discussion is based on Gillingham, Kenneth, Richard Newell and Karen Palmer. 2009. Energy Efficiency Economics and Policy. NBER Working Paper Series.

86 Joskow, P.L. and D.B. Marron. 1992. What does a negawatt really cost? Evidence from utility conservation programs. *Energy Journal*. 13: 41-74. Cited in Gillingham, Newell, and Palmer (2009).

87 (1) Blumstein, C. and J. Harris. 1993. The cost of energy efficiency. *Science* 261: 970. (2) Eto, J, E. Vine, L. Shown, R. Sonnenblick, C. Payne. 1996. The total cost and measured performance of utility-sponsored energy efficiency programs. *Energy Journal*. 17:31-52. (3) Geller, H. and S. Attali. 2005. The experience with energy efficiency policies and programmes in IEA countries: learning from the critics. Paris: Int. Energy Agency. Cited in Gillingham, Newell, and Palmer (2009).

88 Dumagan, J.C. and T.D. Mount. 1993. Welfare effects of improving end-use efficiency: theory and application to residential electricity demand. Resource and Energy Economics. 15: 175-201. Cited in Gillingham, Newell, and Palmer (2009).

have happened" had the program not been implemented. Once a program or change is implemented, it is impossible to directly examine what would have happened in the absence of the program or change. We expect unobserved costs and benefits to complicate calculations of effects on economy-wide well-being. However, empirical economic studies that try to take into account the effects of unobservable costs and benefits can be conducted either through randomized control trials or the use of quasi-experimental designs.

Yet another difficulty in conducting cost benefit analyses for multifamily housing consists of quantifying non-energy or non-water benefits. For example[89], energy-efficient measures can lead to lower electricity bills, which in turn can lead to decreases in unpaid bills. It is very difficult to measure the benefits obtained from reduced bad debt, but these benefits are important, especially when accruing to multifamily dwellings which tend to house low income families for which electricity bills constitute a large portion of their salaries. Another example is the benefits experienced from improved comfort (tenant, stemming for instance from improvements in ventilation and lighting), improved health (tenant, stemming from increases in indoor air quality), and higher resale value (owner). It is important to try to include these benefits in cost benefit analyses.

Several other indirect benefits of energy efficiency are described below, following examples presented in more detail in the University of Florida's FEECA study.[90] These benefits are frequently harder to quantify. Indirect benefits to building owners include higher tenant satisfaction and retention. Indirect benefits to all residents of the state of Florida include reduced fresh water use given the substantial amounts of water required for electricity generation. Other potential indirect benefits described in detail in docket 130200 of the Florida Public Service Commission[91] include the growth of local economies, job growth, and water savings. The rationale behind the first two items stems from the idea that lowering energy costs can enhance economic growth, which in turn creates jobs. Other potential indirect benefits can arise from reductions in electricity production. Avoided electricity generation can, depending on the source, lead to decreases in pollution or waste (typically SO_2, NO_x, CO_2, particulate matter, or nuclear waste), reduced losses in transmission, decreased exposure to fuel price volatility, and other benefits stemming from reduced generation, transmission, and distribution of electricity. Similarly, energy efficiency measures can help Florida prepare for tighter pollution controls and potential carbon emission reduction policies. For instance if the EPA's Clean Power Plan is implemented, energy efficiency measures could prove helpful in achieving compliance.

There are two main types of efficiency impact studies that can be performed: ex ante and ex post. Ex ante studies look at the potential for energy or water efficiency savings, by for example, using simulations. These studies evaluate what we expect to happen. Ex post studies look at the historical effectiveness of energy or water efficiency programs, after they have been implemented.

89 McKibbin, Anne, Anne Evens, Steven Nadel, and Eric Mackres. 2012. Engaging as partners in energy efficiency: multifamily housing and utilities. American Council for an Energy-Efficient Economy and CNT Energy.

90 Galligan, Mary et al. 2012. Evaluation of Florida's Energy Efficiency and Conservation Act. Accessible at: http://warrington.ufl.edu/centers/purc/docs/FEECA_FinalReport2012.pdf

91 Florida Public Service Commission. 2014. Docket 130200—Commission review of numeric conservation goals (Duke Energy Florida, Inc.). Accessible at: http://www.psc.state.fl.us/library/FILINGS/14/05550-14/05550-14.pdf

3.3.1 Energy program cost effectiveness

Common values in the energy efficiency economics literature of the total expense of running an energy efficiency program and installing equipment (known as the “negawatt cost”) per kWh saved as a result of the program range from below $0.01/kWh to above $0.20/kWh saved (in real 2002 dollars).[92] These estimates are not specific to multifamily housing.

Kate Johnson’s study[93] on best practices for energy savings in multifamily buildings summarizes the results of several “well designed” energy efficiency programs in the table presented below (Table 3-2)[94], using historical data obtained from each program. Levelized costs are commonly used in the economics literature and are defined as representing “the costs to the program administrator or utility of acquiring the lifetime energy savings resulting from the program.”[95]

[92] Gillingham, Kenneth, Richard Newell and Karen Palmer. 2009. Energy Efficiency Economics and Policy. NBER Working Paper Series.

[93] Johnson, Kate (2013) “Apartment Hunters: Programs Searching for Energy Savings in Multifamily Buildings”, Report E13N December 2013, American Council for an Energy-Efficient Economy, Washington, DC.

[94] *Ibid.*

[95] *Ibid.* Page 6.

Table 3-2 Efficiency program savings and cost effectiveness; adapted from "Results from Leading Programs" in Johnson (2013).[96]

Program	Annual budget	Annual participation	Annual savi.ngs per unit	Levelized cost of saved energy ($ per kWh & therm) [1]	Benefit-cost ratios [2]
CNT Energy **Energy Savers**	$2,505,952	Units: 4,126 Projects: 110	650 kWh 240 therms	Electric: $0.10 Gas: $1.00	TRC: 2.10 gas
Austin Energy **Power Saver Multifamily Rebates**	$1,600,000	Units: 18,213	433 kWh	Electric: $0.0732	TRC: 1.3 UCT: 2.18
Energy Trust of Oregon **Existing Multifamily Program**	$6,046,110	Units: 21,765 Sites: 1,080	731 kWh 4 therms	Electric: $0.025 Gas: $0.412	UCT: 2.7 SCT: 4.7
LEAN Massachusetts **Low-Income Multi Family Energy Retrofit** [3]	$38,372,271	Units: 14,535 (electric) 6,715 (gas)	1,209 kWh 165 therms	Electric: $0.145 Gas: $1.24	TRC: 1.73 electric 1.43 gas
NYSERDA **Multifamily Performance Program**	$49,099,921 [4]	Units: 28,429 Buildings: 411 Projects: 172	526 kWh 69 therms (2007-2012)	Electric: $0.039 [5]	S.I.R.: 1.8
Puget Sound Energy **Existing Multifamily Retrofit Program**	$10,296,500	Units: 39,489	581 kWh 2 therms	Electric: $0.037 Gas: $0.36 [7]	TRC: 2.42 electric 0.91 gas UCT: 2.96 electric 2.63 gas
Public Service Electric and Gas (PSE&G) **Residential Multifamily**	$14,042,457 [6]	Units: 2,295 Buildings: 79 Projects: 11	810 kWh 153 therms	Electric: ~ $0.03 to $0.05 per	TRC: 2.9 UCT: 1.39
Efficiency Vermont **Multifamily Program for New Construction & Major Rehabilitation**	$1,940,381	Units: 450 comprehensive services plus additional rebates	Not available	Electric: $0.07	TRC: 2.79

[96] Johnson, Kate (2013) "Apartment Hunters: Programs Searching for Energy Savings in Multifamily Buildings", Report E13N December 2013, American Council for an Energy-Efficient Economy, Washington, DC. Page vi.

Program	Annual budget	Annual participation	Annual savi.ngs per unit	Levelized cost of saved energy ($ per kWh & therm) [1]	Benefit-cost ratios [2]
Sacramento Municipal Utility District (SMUD) Multifamily Home Performance Program	$1,700,000	Units: 1,200 (goal)	1,980 kWh 42 therms/unit (2009-2012)	Electric: $0.08	Not available
New and notable programs					
CenterPoint Energy Low Income Multifamily Rebates	$287,250	Not yet available	Not yet available	Gas: $0.16 [8]	UTC: 4.56 SCT: 4.70 PCT: 6.70
ComEd, Nicor Gas, and People's Gas Multifamily Comprehensive Energy Efficiency Program	$19,000,000	Units: 88,750 (goal) Projects: 900 (goal)	437 kWh (goal) 101 therms (goal)	Not available	Not available
DC SEU Low-Income Multifamily Comprehensive	$1,200,000	Units: 348 Projects: 5	2,222 kWh 33 therms	Not available	SCT: 1.88

Notes and sources: All figures are as reported through information requests submitted by each of the programs unless noted.

1 Levelized costs are as reported unless noted.

2 Benefit-cost rations are determined using standard testing methods including the Total Resource Cost Test (TRC), Utility Cost Test (UCT), Societal Cost Test (SCT), and Savings to Investment Rations (SIR). A value of 1 means the program costs and benefits, which are defined differently depending on the methodology used, are equal.

3 Participation, savings and benefit-cost ratios for the Massachusetts Low-Income Retrofit Program are reported statewide to the Massachusetts Energy Efficiency Advisory Committee (MA EEAC 2013). Levelized cost of saved energy was calculated using reported annual savings, utility costs, and average measure life and an assumed real discount rate of 5%.

4 Eight year NYSERDA program budget annualized.

5 Levelized cost of saved energy for System Benefit Charge funded activities only using a 5.5% discount rate as reported in NYSERDA 2012, Table 2-12.

6 Actual PSE&G 2013 expenditure as reported in Nowak et al 2013.

7 Levelized cost of saved energy calculated using PSE's reported savings, utility costs, and estimated average measure life (PSE 2013) and an assumed real discount rate of 5%.

8 CenterPoint Energy's Levelized cost of save energy calculated using projected savings, utility costs, and average measure life and an assumed real discount rate of 5%.

In 2007, ACEEE conducted a study[97] of Florida's energy efficiency potential, through detailed building energy use analysis. For residential efficiency, the study found that existing homes had the potential to achieve significant energy savings. Specifically, "at a levelized lifecycle cost of about $0.10 or less per kWh saved, homeowners can reduce electricity consumption by up to 28%" by implementing energy efficiency measures outlined in the study.[98] The study also estimated that the economic savings from implementing the energy efficiency policies recommended had the potential of reducing the electricity bills of Florida's consumers by $28 billion by 2023.

There have been several multifamily ex post studies of energy efficiency. It is expected that more of these studies will be available as more energy efficiency programs are implemented. The California Statewide Multifamily Energy Efficiency Rebate Program[99] measured savings for the 2004-05 and 2006 program years and found that energy efficiency improvements in over 410,000 multifamily housing units resulted in annual savings exceeding 141 million kWh of electricity. This program stands out because it attempted to overcome the split incentive problem by giving incentives to owners to invest in energy efficiency measures inside the tenants' residences.

For Florida multifamily buildings specifically, a recent study[100] examined the impacts of energy-efficiency upgrades in the form of retrofits to buildings in four apartment complexes (232 units) in the city of Orlando. The study estimated annual electricity savings of 22%, which translated to average savings of $272 on electric bills. This study also found evidence in support of targeted upgrades.

In 2013, Talquin Electric Cooperative, serving approximately 52,000 electricity customers in northwest Florida, conducted a study aimed at evaluating the efficacy of its Energy Usage Analyses (EUA). The study notes that the utility conducted 350 residential EUA in 2011, and randomly selected 100 for inclusion in the study. Talquin observed that the customers reduced their electricity consumption by 12.8% in the year following the EUA, and after adjusting for the differences in heating and cooling degree days, concluded that consumption reduction attributable to the program was 2.0%. The study concludes that if these results were replicated system-wide, the reductions would have been approximately 13-15 GWh per year.

An interesting exercise that can take place once sufficient data are available is comparing the predictions of ex ante engineering simulation studies to ex post economics studies. A recent article in the economics literature[101] examined the effect of a change in the energy code of buildings in Gainesville, Florida, using residential billing data and building characteristics. The authors compared residences built before and after the energy code change of 2002. The study found that the change in Florida's code was associated with a 4% decrease in the consumption of electricity. This study estimates a cost benefit analysis and finds that the average social and private payback period for this change ranges between 3.5 and 6.4 years. The costs are measured as the increase in compliance costs with a more stringent code, while the benefits are measured as lower utility bill expenditures and avoided social costs of pollution. While this study does not examine

97 Elliot, R. Neal, M. Eldridge, A. M. Shipley, J. Laitner, S. Nadel, P. Fairey, R. Vieira, J. Sonne, A. Silverstein, B. Hedman, and K. Darrow. 2007. Potential for energy efficiency and renewable energy to meet Florida's growing energy demands. American Council for an Energy-Efficient Economy, Report E072.

98 *Ibid.* Page 8.

99 McKibbin, Anne, Anne Evens, Steven Nadel, and Eric Mackres. 2012. Engaging as partners in energy efficiency: multifamily housing and utilities. American Council for an Energy-Efficient Economy and CNT Energy.

100 Taylor, Nicholas W., Jennison K. Searcy, and Pierce H. Jones. 2014. Multifamily Energy-Efficiency Retrofit Programs: a Florida Case Study. PREC working paper.

101 Jacobsen, Grant D. and Matthew J. Kotchen. 2013. Are building codes effective at saving energy? Evidence from residential billing data in Florida. The Review of Economics and Statistics, 95(1):34-49.

multifamily buildings specifically, it stands out in that it tries to account for behavioral responses, uses ex post analysis for a city in Florida, and adds confidence to the reliability of ex ante engineering simulations used in the state of Florida. While warning that it is difficult to directly compare engineering to economic studies, the authors find that their results are "not statistically different" from the ex-ante predictions of an engineering simulation model conducted by EnergyGauge.

Another study,[102] also conducted in Alachua County, Florida, examined the energy efficiency performance of 1,346 new homes that built between 1998 and 2009 and were scored by the Home Energy Rating System (HERS). The study used historical consumption data to measure the post-occupancy performance of HERS-rated homes relative to that of conventionally built homes. For the year 2000, average energy savings for HERS-rated homes was estimated at 18%, yet these savings "degraded steadily, stabilizing around 7% in the last 5 years of the analysis."[103] The study also found that there were differences in energy savings among the builders of HERS buildings, which the authors attribute to differences in implementation and construction practices, highlighting the importance of implementation.

A recent study[104] of an energy efficiency program in the city of Gainesville, Florida examined a high efficiency central air conditioner rebate program offered by the local municipally-owned utility company, providing incentives for the replacement of low-efficiency AC units. The study found substantial annual energy savings. The study also found that there did not seem to be a "rebound effect". A rebound effect would occur if participants increased their electricity use as a consequence of the decline in their electricity bill accruing from the use of more energy-efficient AC units. Studies of this sort are more easily conducted in cities such as Gainesville (in Alachua County, FL) because they have accessible data on electricity use. Keeping track of relevant data and making it accessible to researchers allows for academic studies to take place. Those studies in turn can use the data to measure the effectiveness of these programs. Access to such data by researchers is a relatively cheap and easy way to enable the measurement of program success and savings.

"Greater energy savings are more likely to be realized from the integration of measures in multifamily energy efficiency programs than in single family programs

Lower costs can be achieved if economies of scale are reached. Economies of scale could potentially be achieved when several properties are owned by the same owner. This is because administrative and transaction costs would be spread out over a larger number of units. It is also easier, for example, to coordinate retrofits for several contiguous apartments than for individual homes. Additionally, any benefits from the retrofit experience accrued by an owner may be applicable to other multifamily properties.

Greater energy savings are more likely to be realized from the integration of measures in multifamily energy efficiency programs than in single family programs.[105] For example, installing a central domestic hot water system with a recirculation loop is more energy efficient (and has lower upfront costs) than having several individual water heaters. Furthermore, opportunities for increasing energy efficiency measures exist when equipment needs to be replaced.

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[102] Taylor, Nicholas W., Pierce H. Jones, Jennison K. Searcy, and Craig R. Miller. 2014. Evaluating Ten Years of Energy Performance of HERS-Rated Homes in Alachua County, FL, *Energy Efficiency,* 7(4): 729-741.

[103] *Ibid*. Page 729.

[104] Boampong, Richard. 2014. Evaluating the Energy Savings Effect of a Utility Demand-Side Management Program using a Difference-in-Difference Coarsened Exact Matching Approach. PURC working paper.

[105] This description is taken from Benningfield Group, Inc. 2009. U.S. Multifamily energy efficiency potential by 2020.

3.3.2 Water program cost effectiveness

There are very few economic studies of water efficiency programs. The economics literature on demand side management of water often focuses on price and quantity responses to water scarcity. These measures are highly effective and are often preferred by economists because they can, for example, reflect the scarcity of water in times of drought. They are not addressed in detail here because they fall under conservation. The main study[106] of the relationship between prices and usage for water utilities in Florida finds that, as expected, water use decreases as price increases and that water use increases with wealth. The study also finds that fixed charges, where customers pay the same fee regardless of actual water use, are not correlated with water use. This implies that consumers behave differently when paying a fixed fee compared to fees that vary with actual water usage and that having a fixed fee fails to send price signals to customers.[107] The study underscores the importance of water pricing in managing water resources.

More recent Florida data from the St. John River Water Management District and Max Castaneda's Florida Automated Water Conservation and Evaluation Tool (FAWCET), show a striking relationship between water rates and the percentage of customers falling in the 1,000, 2,000, 6,000 and 15,000 gallon use categories. The higher the rates, the higher the percentage of consumers falling in the lowest gallon use categories. Water rates also vary considerably across Florida utilities, with some customers paying as much as four times more than those in other utility districts for the same amount of water used.

As with energy efficiency studies, economic studies of water efficiency try to mitigate the effects of unobservable factors such as indirect benefits and costs.[108] A recent study[109] examined the cost effectiveness of a rebate program for high efficiency toilets. This study combined water use data during three years from households that participated in the program plus a matched sample of neighbors who did not participate and a survey to determine each household's motivation for participating in the program. The neighbors were used as comparison points. The main goal was to estimate the degree to which the policy led to water efficiency improvements. The study found that high efficiency toilets reduce water consumption by roughly 7%, but that the rebate program provided limited additional water savings once the natural replacement of older appliances was taken into account. This study used data from North Carolina residential units. The estimates for reductions in water consumption are similar to those found in ex ante engineering studies. This study differs from EPA calculations in that EPA calculations assume that all of the toilets in a household are replaced. With respect to cost effectiveness, the article finds that while the rebates are not cost effective, more direct targeting of high efficiency toilet replacement incentives by utilities can be quite cost effective.

A study by the Western Resource Advocates[110] provides cost and savings information for several types of water efficiency measures. For example, a residential high efficiency clothes washer can save over 111,500 lifetime gallons of water, while the installation of a single low-flow toilet can save 325,000 gallons over the

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106 Whitcomb, John B. 2005. Florida Water Rates Evaluation of Single-Family Homes. Specific elasticities for different income groups are available in the study.

107 Additionally, equity issues may arise when fixed fees disproportionately affect lower use/lower income users.

108 Indirect costs and benefits are described in section 3.3. They include, for example, benefits from reduced bad debt, which can occur when lower income renters have lower water bills.

109 Bennear, Lori, Jonathan Lee, and Laura Taylor. 2013. Municipal rebate programs for environmental retrofits: an evaluation of additionality and cost-effectiveness. *Journal of Policy Analysis and Management*, Vol. 32, No. 2, 350–372.

110 Tracy Hern, with assistance from Taryn Hutchins-Cabibi, Bart Miller, and Nicole Theerasatiankul. 2008. Smart Savings Water Conservation Measures that Make Cents. Western Resource Advocates.

lifetime of the toilet. For Florida, a cost benefit analysis of water efficiency measures adopted in 26 single family Tampa homes[111] using historical data examined the payback periods of toilets (under 2 years), washers (6 years), showerheads (1.6 years) and faucets (12 years). All of the estimates compared favorably to each product's expected lifetime, suggesting that these measures could be good candidates for beneficial government or utility investment programs.

Even though no economic studies of water efficiency measures specific to multifamily housing are available to our knowledge, case studies are available. A study of HUD's 2009 Green Retrofit Program, which targeted energy and water savings retrofits in multifamily housing[112] found that water retrofits (low flow faucets, showerheads and toilets) reduced water consumption by an average of 26%, or 23 gallons per bedroom per day. The water retrofits were exceedingly cost-effective with a simple payback period of 1 year and a savings to investment ratio (SIR) of 9. The cost savings for the 162 participating complexes totaled approximately $1.2 million per year.

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[111] Mayer, Peter, William B. DeOreo, Erin Towler, Leslie Martien, and David M. Lewis. 2004. Tampa water department residential water conservation study: the impacts of high efficiency plumbing fixture retrofits in single-family homes. Aquacraft, Inc. Water Engineering and Management.

[112] Braman, J, S. Kolberg, and J. Perlman. 2014. Energy and Water Savings in Multifamily Retrofits. Results from the U.S. Department of Housing and Urban Development's Green Retrofit Program and the Energy Savers Program in Illinois.

4. Existing Policies and Programs for Multifamily Building Efficiency – Energy and Water

Florida's existing energy efficiency and water conservation programs are best understood in the context of existing federal and state policies and the entities that encourage or implement programs. Utilities, local governments, non-profit organizations, independent contractors and inspectors all play a role in making multifamily housing more efficient. One way to think of policies is that they typically apply strategies that are regulatory, economic, incentive-based, educational, or technical in nature to achieve energy efficiency or water conservation goals (sometimes a combination). These policies also provide a background for any recommendations to emerge from this study. This section details existing policies, programs and codes for both energy and water efficiency in Florida and in other states, with a focus on those that apply to multifamily and/or rental housing specifically.

4.1 Building codes and ordinances

This section details provisions in building and housing codes—nationally, in Florida, and in other states—that address or apply to energy and water efficiency opportunities in multifamily buildings.

4.1.1 National building codes

The Florida Building Code process starts with national codes (the International Construction Code or ICC). The ICC is updated every three years. The code has increased in stringency over the years. Most building codes are separated into residential and commercial construction with the division occurring for multifamily housing at structures three stories or taller and not having other uses than residential. There are generally not many portions of the codes affecting energy or water that address low-rise multifamily housing relative to single- family detached housing. Furthermore, there are very few requirements regarding existing housing.

The ICC allows a number of paths to compliance with building codes. They generally fall into three categories. One method is *prescriptive* where each component or combination of components must meet a specified level of efficiency. For example, the ceiling insulation must be a certain thermal resistance (R-value). Another method is *performance* where there is great deal of flexibility of each component. The building performance is simulated against a similar size building with specified levels of efficient components. A third method employs available *whole building rating systems*. The 2015 International Energy Efficiency Code allows compliance by the Home Energy Rating System (HERS). The HERS index includes appliance and lighting energy use not inherent in performance code methods historically part of the ICC.

4.1.2 Florida codes and ordinances

At the state level, a number of Florida energy and water code-related items of relevance to this study were identified. While the research suggests a somewhat "hands off" Florida code approach to existing buildings, other findings may still provide opportunities for significant multifamily energy and water savings via renovations and replacements, code enforcement and in the case of high rise units, addressing specific technical issues. Code items involving energy only are listed first, followed by water only items, then combined energy and water items.

- [Energy] Florida Energy Conservation Code Existing Buildings: Both the current 2010 and draft 2014 Florida Energy Conservation codes appear to have a "hands off" approach to existing buildings. Section 101.4 of the Florida Energy Conservation code (Section R101.4 of the 2014 draft code) addresses existing buildings, but mainly concerns when changes are being made. Section 101.4.1 (R101.4.1 in the 2014 draft code) states: "Except as specified in this chapter, this code shall not be used to require the removal, alteration or abandonment of, nor prevent the continued use and maintenance of, an existing building or building system lawfully in existence at the time of adoption of this code."[113]
- A Declaratory Statement issued earlier this year by the Florida Building Commission regarding Florida House Bill 269 removed the 2010 residential Florida Energy Conservation Code requirement to seal ducts and perform a sizing calculation at the time of a complete AC change-out. The FBC Statement seems consistent with a "hands off" existing buildings approach.
- [Energy] Existing Building Repairs and Renovations: There has been some discussion as to whether alterations, renovations and repairs to existing buildings and system and component installations and replacements are required to be brought up to current, 2010 code efficiency levels. The final decision in these cases has been left up to the individual building official. While the applicable sections of the 2010 and draft 2014 Florida Energy Conservation codes are similar (R101.4.3 and R101.4.7 in the 2014 code), it is anticipated that the changes included in the 2014 code will help clarify code requirements and may improve efficiency of existing buildings when applicable repairs and renovations are made.
- [Energy] Code Enforcement: A Florida HVAC association official noted extensive licensing and code violations and mismatched AC equipment (often installed by unlicensed handymen) at large multifamily developments in his area. He noted that enforcement of Florida's existing licensing laws and energy code (by pulling permits) would provide a more effective means of saving energy in the multifamily sector than a new efficiency program.[114] A Florida Building Commission member agreed with the HVAC association official's assessment that enforcing existing licensing laws and the energy code in multifamily developments is a significant issue.[115]
- [Energy] High Rise Exhaust Fan Balancing: The same HVAC association official noted above also identified exhaust fan balancing in Florida high rise multifamily buildings as an important issue. He noted that balancing exhaust fans (slowing them down) is very rarely done but in his experience has

[113] Florida Building Code, Energy Conservation, International Code Council, Inc. (2010). Retrieved from http://ecodes.biz/ecodes_support/free_resources/2010Florida/Energy/10FL_Energy.html
[114] Stakeholder communication, November 5, 2014.
[115] Stakeholder interview, November 2014.

typically resulted in outside air requirement reductions of over 50%.[116] This exhaust fan balancing direction could possibly be pursued as a code item or through other avenues such as education.

- [Water] Florida Plumbing Code Reclaimed Water: Section 602.4 of the current 2010 and draft 2014 Florida Plumbing Code allows reclaimed water to be used for "flushing water closets and urinals and other fixtures which do not require potable water…"[117]
- [Water] Florida Plumbing Code Maximum Flow and Water Consumption: Section 604.4 of the current 2010 and draft 2014 Florida Plumbing Code specifies maximum water consumption flow rates for plumbing fixtures.

4.1.3 Other state statutes and local ordinances

A wide range of energy and water efficiency code related items were identified from other states, including general weatherization, efficiency requirements, publicly available energy audit and benchmarking results, financing requirements, water consumption limits and fixture replacements. Code items involving energy only are again listed first, followed by water only items, then combined energy and water items.

- [Energy] International Energy Conservation Code[118]: Florida's Energy Conservation Code uses the International Energy Conservation Code (IECC) as its base code. A number of other states also use the IECC or IECC with modifications for their energy code; as a result, many of these codes also include the Section 101.4.1 language provided above that prohibits the use of the code to require changes to existing buildings.
- [Energy] Ann Arbor, MI Housing Code Chapter 105 §§8:524 (1987) Information Regarding Utility Charges[119]: This code requires a budget plan to be provided to the tenant before a lease is entered into. 'Budget plan' is defined as a public utility prepared projection of monthly utility costs for primary heating fuel.

  > This section shall apply to the rental of all dwelling units for which budget plan information is available from the utility company without charge and in which the tenant is required to pay the owner or the utility company a utility charge for heating fuel in addition to rent.

- [Energy] Ann Arbor, MI Housing Code Chapter 105 §§8:528 (1987) Basic Winterization in Rental Housing[120]: This code requires rental units to be weatherized as stipulated in the code section. Weatherization requirements include weather-stripping or caulking exterior cracks and gaps and ceiling insulation.

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[116] Stakeholder communication, November 5, 2014.

[117] Florida Building Code, Plumbing, 5th Edition (2014) Draft, International Code Council, Inc. (2014). Retrieved from http://ecodes.biz/ecodes_support/free_resources/14FloridaDraft/Plumbing/14FL_Plumbing_Draft.html

[118] International Energy Conservation Code, International Code Council. (2012). Retrieved from http://publicecodes.cyberregs.com/icod/iecc/IC-P-2012-000014.htm?bu2=IC-P-2012-000019

[119] Ann Arbor, Michigan Housing Code, Chapter 105 §§8:524 (1987). Retrieved from https://www.municode.com/library/mi/ann_arbor/codes/code_of_ordinances?nodeId=TITVIIIBURE_CH105HOCO

[120] *Ibid.*

- [Energy] Austin Texas Energy Conservation Code: Ordinance 20110421-002[121]: This ordinance requires the owner of a multifamily facility to "post and provide to current and prospective tenants the results of the energy audit required under this article." In cases where the average per-square-foot energy use exceeds 150% of the average for multifamily facilities within the Austin Electric Utility service area, the ordinance requires improvements that reduce the average per-square-foot energy use by 20%.
- [Energy] Seattle Washington Energy Efficiency Performance Disclosure; Ordinance Number 123226[122]: Owners of buildings subject to multifamily benchmarking requirements must provide "…using the Energy Star Portfolio Manager or a similar rating system and in such form as established by Director's rule, an initial energy benchmarking report and, where available, an energy performance rating for each building…" Upon request, owners must provide the benchmarking report and performance rating to tenants, prospective tenants, prospective buyers and lenders. Tenants must provide non-personally identifying information that is needed by the building owner to comply with the requirements.
- [Energy] Alaska Statute 46.11.050[123]: Financial institutions must take the economic benefits of alternative energy systems, life-cycle energy costs, energy-efficient building design, and energy conservation into consideration when financing homes and buildings with state financial assistance. Home mortgage loan applicants must provide the financial institution or state agency with an energy audit.
- [Energy] Minnesota Next Generation Energy Act of 2007[124]: This legislation in part requires that landlords fit residential for-rent properties with "weather stripping, caulking, storm windows and storm doors when any such measure "will result in energy procurement cost savings ... that will exceed the cost of implementing that measure."
- [Energy] Palo Alto California Ordinance 5070[125]: For low rise (3 stories or less), the ordinance requires the performance approach specified in Section 151 of the 2008 California Building Energy Efficiency Standards be used to demonstrate that the Proposed building's Time Dependent Valuation (TDV) of Energy is at least 15.0% less than that of the Standard Design. Compliance constitutes achievement of GreenPoint Rated's minimum energy prerequisite for new "Multi-Family Residential" construction. For high rise (4 stories or more), the ordinance requires modeling the Proposed Design's building envelope and mechanical system consistent with 2008 Title 24 performance method rules and demonstrating that the Proposed Design's TDV Energy of the Proposed Design is less than that of the Standard Design by the percentage (%) required in the 2009

[121] Austin, Texas City Code Ordinance 20110421-002. (2011). Retrieved from http://www.austinenergy.com/wps/wcm/connect/deb31977-bc57-4025-ba84-237ae9588aae/ordinance.pdf?MOD=AJPERES

[122] Seattle Washington Municipal Code, Title 22 Chapter 22.920. (2010). Retrieved from http://clerk.ci.seattle.wa.us/~scripts/nph-brs.exe?s1=&s3=116731&s4=&s2=&s5=&Sect4=AND&l=20&Sect2=THESON&Sect3=PLURON&Sect5=CBORY&Sect6=HITOFF&d=ORDF&p=1&u=/~public/cbory.htm&r=1&f=G

[123] Alaska Statute 46.11.050 (2013). Retrieved from http://www.legis.state.ak.us/basis/statutes.asp#46.11.050

[124] Minnesota Next Generation Energy Act (2007). Retrieved from http://www.nextstep.state.mn.us/res_detail.cfm?id=4034

[125] Palo Alto, California Municipal Code, Title 16, Chapter 16.18 (2010). Retrieved from http://www.cityofpaloalto.org/civicax/filebank/documents/18343

GreenPoint Rated new “Multi-Family Residential” construction guidelines. Compliance constitutes achievement of GreenPoint Rated’s minimum energy prerequisite for new “Multi-Family Residential” construction.

- [Water] Oregon Reach Code (2011)[126]: Chapter 7, Water Resource Conservation and Efficiency addresses conservation of potable and non-potable water in and around buildings. The code includes consumption limits and a water savings calculator.
- [Water] Manhattan Beach, California Toilet Retrofit Ordinance[127]: This 2010 ordinance requires all existing residential buildings to be retrofitted with high efficiency toilets at time of sale (if not already high efficiency) that meet the current EPA Water Sense program requirements.
- [Energy and Water] The Greener, Greater Buildings Plan (GGBP)[128]: New York City energy efficiency laws targeting the city’s largest existing buildings require renovations that impact energy systems to meet the New York State energy code, annual energy efficiency and water use benchmarking with public disclosure, and an audit and retro-commissioning every ten years. Requirements for non-residential spaces include lighting upgrades to meet the energy code.
- [Energy and Water] Boulder Colorado Property Maintenance Code[129]: Chapter 10-2 of the Boulder Revised Code (Appendix C) requires residential rental dwelling units to comply with either performance or prescriptive-based energy efficiency options. The performance compliance option requires a HERS index of 120. The prescriptive option requires a total score of 100 points based on a point table provided for various components, and also includes mandatory water conservation measures. Effective date is January 2, 2019.
- [Energy and Water] San Francisco Residential Energy and Water Conservation Requirements[130]: San Francisco has a Residential Energy Conservation Ordinance (RECO) and separate Residential Water Conservation Ordinance which together require residential property owners wishing to sell their property to “obtain a valid inspection, install certain energy and water conservation devices or materials and then obtain a certificate of compliance.” The efficiency improvements are also required at meter conversion, at time of major improvements or if a building is converted to a condo. Energy improvements include attic, water heater and duct insulation and sealing exterior openings. Water conservation requirements include low flow showerheads, faucet aerators, efficient toilets and plumbing leak repairs.

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126 Oregon Reach Code, International Association of Plumbing and Mechanical Officials (2010). Retrieved from http://ecodes.biz/ecodes_support/free_resources/Oregon/11_Reach/11_ORReach_main.html

127 Manhattan Beach, California Municipal Code, Title 9, Chapters 24 and 36 (2010). Retrieved from http://www.ci.manhattan-beach.ca.us/city-officials/community-development/toilet-retrofit-program

128 *Overview of the Greener, Greater Buildings Plan.* (2014). New York City Mayor’s Office of Long-Term Planning and Sustainability. Retrieved from http://www.nyc.gov/html/gbee/downloads/pdf/greener_greater_buildings_plan.pdf

129 Boulder, Colorado Property Maintenance Code, Chapter 10-2 Appendix C (no date). Retrieved from http://www.colocode.com/boulder2/chapter10-2.htm

130 *What You Should Know About San Francisco’s Residential Energy and Water Conservation Requirements.* (2009). San Francisco, California: Department of Building Inspection. 2009. Retrieved from http://sfdbi.org/sites/sfdbi.org/files/migrated/FileCenter/Documents/Brochures_and_Publications/Residential_WaterConservation_Ordinance_Brochure.pdf

- [Energy and Water] Montana Housing Rehabilitation Standards[131]: Residential gut rehabilitation or new construction up to three stories must meet the ENERGY STAR Qualified New Homes standard. Multifamily housing gut rehabilitation or new construction of four or more floors must meet American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) Standard 90.1-2004, Appendix G plus 20 percent. Other (less than full rehabilitation) rehabilitation must meet these standards as applicable (replace with ENERGY STAR labeled components and appliances). "Water efficient toilets, showers, and faucets, such as those with the WaterSense label, must be installed."
- [Energy and Water] Roseville California Energy Conservation Audit Requirements[132]: Prior to the sale of any dwelling unit, the seller is required to have an energy audit performed to determine compliance with specified energy conservation standards which include attic insulation, duct sealing, weather-stripping, water heater insulation, low flow shower heads and window shading devices. If one or more of the energy conservation standards have not been met, the energy auditor is to provide an advisory report outlining the costs and benefits associated with meeting those standards along with information to aid in the installation of the conservation measures.
- [Energy and Water] Private Development Green Building Ordinance of the City of Hayward California[133]: Prior to obtaining a Certificate of Occupancy, new Multi-Family Residential Covered Projects applicants must document that the building(s) has/have been GreenPoint Rated (http://greenpointrated.com/about/) and were in full compliance with the California Building Energy Efficiency Standard (Title 24, part 6) at the time of permitting. Cost effectiveness of the ordinance is based on the findings of a January 2009 study: "Energy Cost Effectiveness Case Studies Using the 2008 Title 24 Building Energy Efficiency Standards."
- [Energy and Water] Berkeley California Residential Energy Conservation Ordinance (RECO)[134]: The ordinance requires that at time of sale or renovation valued at $50,000 or more, every home and apartment building meet specified energy and water efficiency requirements. Includes spending limits and do-it-yourself tips.

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131 *Montana Department of Commerce Annual Action Plan NSP Amendment.* (2011). Montana Department of Labor and Industry: Building Codes Bureau. Retrieved from http://comdev.mt.gov/content/NSP/docs/NSP3Documents/NSP3Amendmenttoactionplan/housingrehabstandards

132 Roseville, California Municipal Code, Title 16, Chapter 16.18 (2014). Retrieved from http://qcode.us/codes/roseville/

133 Hayward, California Municipal Code, §§ 10-22 (2014). Retrieved from http://www.hayward-ca.gov/CITY-GOVERNMENT/DEPARTMENTS/CITY-CLERK/MUNICIPAL-CODE/GreenBuildingRequirementsforPrivateDevelopment.pdf

134 Berkeley, California Municipal Code, Chapter 19.16 (2008). Retrieved from http://www.ci.berkeley.ca.us/uploadedFiles/Planning_and_Development/Level_3_-_Energy_and_Sustainable_Development/Residential%20Energy%20Conservation%20Ordinance%20Compliance%20Guide%202008.pdf

4.2 State (Florida) energy efficiency policies and programs

4.2.1 Utility-sponsored programs

> *"Utilities, local governments, non-profit organizations, independent contractors and inspectors all play a role in making multifamily housing more efficient.*

There are five investor owned utilities, 35 municipal electric utilities, and 18 rural electric cooperatives operating in the state of Florida. The Florida Energy Efficiency and Conservation Act (FEECA) was enacted in 1980 and has been amended multiple times.[135] FEECA aims at controlling the growth rates of electricity use, and reducing the use of scarce resources, such as petroleum fuels. The Florida Public Service Commission is statutorily required to set appropriate conservation goals for the seven electric utilities subject to FEECA at least every five years. At present five electric investor-owned utilities and two large municipal utilities are subject to requirements in the Act although several municipal electric utilities and rural electric cooperatives offer their own energy efficiency incentives or programs.[136]

The investor-owned electric utilities subject to FEECA include Florida Power & Light Company, Duke Energy Florida, Gulf Power Company, Tampa Electric Company, and Florida Public Utilities Company. The two municipal utilities are Orlando Utilities Commission and Jacksonville Electric Authority. The utilities subject to FEECA requirements account for more than 90% of all energy sales in Florida. Under the Act, the Florida Public Service Commission is required to set conservation goals for each utility. Once goals are established, each utility develops programs that must be approved by the FPSC. The intent of these programs is to enable residential, commercial, and industrial customers to improve their energy efficiency. The FPSC and FEECA-covered utilities, at the time of this writing, are involved in a goal-setting process. Utilities must submit plans for meeting new goals set for them. Once utility plans for meeting those goals are implemented, the participating utilities are allowed to recover from ratepayers their prudently incurred FEECA-related costs through the Energy Cost Recovery Clause (ECCR). Seven natural gas local distribution companies are also covered by FEECA and are permitted to recover energy conservation program costs through the ECCR. Unlike electric utilities, they are not subject to the goal setting process.

Each utility's programs are different but all utilities are statutorily required to offer residential audits at no cost. (Like electric utilities, natural gas companies are required to offer or contract to offer energy audits.) In addition to audits, the FEECA-covered electric utilities' programs may include rebates and incentives for appliances that exceed federally established minimum efficiency standards. Other components of a FEECA program include consumer education and outreach and the installation of specified conservation and energy efficiency measures in approved plans. Several utility-sponsored programs apply to multifamily housing, such as Duke Energy's Neighborhood Energy Saver Program which installs up to 16 measures at no cost in houses and apartments in targeted low-income neighborhoods. Duke Energy Florida also offers a Multifamily Energy Improvement Program which provides a free home energy check and incentives and

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135 See Sections 366.80 et seq. and Section 403.519, F.S.

136 See Florida Public Service Commission, Annual Report on Activities pursuant to the Florida Energy Efficiency & Conservation Act, February 2014, http://www.psc.state.fl.us/publications/pdf/electricgas/FEECA2014.pdf. Accessed December 2014.

rebates directed to improving energy efficiency.[137] FPL, Gulf Power, FPUC, and JEA offer rebates for select measures to multifamily residents.

Even though there is no prohibition against authorizing more utility-sponsored multifamily programs under FEECA, there are several constraints. The FPSC is only allowed to approve programs that are deemed cost effective (by passing certain specified cost-benefit tests). Moreover, energy efficiency savings under FEECA decline when federal efficiency standards go up, consumers independently implement their own conservation measures, and the supply of power becomes cheaper relative to demand side measures.

> *"Each utility's programs are different but all utilities are statutorily required to offer residential audits at no cost.*

4.2.2 Energy efficiency resource standards (EERS) / renewable portfolio standards (RPS)

There is no federal Energy Efficiency Resource Standard nor is there a federal Renewable Portfolio Standard. Therefore, such measures if they are adopted fall under the jurisdiction of states. According to ACEEE, 24 states have Energy Efficiency Resource Standards as of October 2014 (Florida is not included in its list as it lacks a sustainable funding source).[138]

According to ACEEE, the highest standards are found in Massachusetts, Rhode Island, and Vermont which require savings of almost 2.5% annually. In some states energy efficiency can also be applied to meeting Renewable Portfolio Standards (RPS). Florida does not have an RPS and its goal setting targets for the utilities are set at approximately 3.3% in cumulative energy savings for the period 2010-2019.

4.2.3 Decoupling policy

Utilities inherently have a "throughput" incentive to sell more energy and thereby increase profits. Rate decoupling involves the separation of a utility's profits from its sale of the commodity, in this case electricity. Decoupling establishes the revenue to cover a utility's identified or fixed costs and then allows rates to change with consumption to meet revenue targets. Without decoupling, energy efficiency programs dampen or reduce a utility's profits. Unlike half the states, Florida has not adopted a statewide decoupling policy. As noted in a fact sheet by the Alliance to Save Energy, "decoupling in and of itself does not provide utilities with incentives to increase energy efficiency. Rather, it removes the "throughput" incentive that discourages such efficiency. To promote energy efficiency, decoupling policies should be combined with other policies that require or incentivize energy efficiency."[139]

In 2008, in compliance with a state statutory requirement, the FPSC considered decoupling. The Commission ultimately decided that a significant portion of a utility's revenues were already being recovered through the annual ECCR clause reviews, thus making decoupling less necessary.[140]

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137 Duke Energy, Multi-Family Energy Improvement Program, https://www.progress-energy.com/florida/home/save-energy-money/energy-efficiency-improvements/multi-family-programs/index.page. Accessed December 2014.

138 Annie Gilleo, Anna Chittum, Kate Farley, Max Neubauer, Seth Nowak, David Ribeiro, and Shruti Vaidyanathan, The 2014 State Energy Efficiency Scorecard, American Council for an Energy-Efficient Economy, http://www.aceee.org/sites/default/files/publications/researchreports/u1408.pdf. Accessed December 2014.

139 Alliance to Save Energy, Fact sheet: Utility Rate Decoupling, October 24, 2013, https://www.ase.org/resources/utility-rate-decoupling-0. Accessed December 2014.

140 Florida Public Service Commission, Report to the Legislature on Utility Revenue Decoupling, December 2008,

4.2.4 Rate design (state/local)

Energy efficiency may also be spurred by features of specific utility rate design. Specifically, if utility rates increase relative to consumption, consumers may be motivated to curb consumption, either by using less energy or by installing more energy-efficient appliances in their homes or apartments. Rate designs associated with potentially encouraging more energy-efficient behavior may include inclining (or inverted) block rates, and seasonal or time of use rates. Each type of rate design has limitations.[141] Rates design and rates are proposed by utilities and must be approved by the FPSC (for the investor owned utilities). Florida's municipal utilities and rural electric cooperatives are not subject to the Commission for rate setting purposes although the Commission has some jurisdiction over rate design.[142]

Water conservation and efficiency may also be encouraged by rate design. Most water utilities charge a base customer rate and two to five inclining block rates, although a few use flat consumption charges. Several factors influence the sensitivity of water consumption to price:

- The overall cost of water is very low compared to what customers spend for other utilities—energy, wastewater, telephone. Unless a tenant or building owner is very motivated, the absolute cost of water bills may seem insignificant.
- Florida's average water rates are relatively low. Based on a 2014 rate comparison, the average residential water price (including wastewater charges) across nine Florida utilities is $11 per thousand gallons (about a penny per gallon). Average rates in Atlanta, San Francisco and Honolulu are twice as high.[143]
- The complexity of water rates, composed of a base customer rate plus block rates that increase in steps at set volumes make them more difficult to understand.
- Building owners paying for master-metered water (a single bill for a group of apartments) are able to pass the water cost to their tenants with little attention actually paid to the amount consumed.
- Most Florida utilities do not provide full rate (base and unit pricing) information on customer bills, and while many customers are concerned about the cost of water, they lack tools and information to understand how their use relates directly to their water bill charges.[144]
- Occupants and building owners may be unaware of possibilities to increase water efficiency without sacrificing convenience or functionality.

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http://www.psc.state.fl.us/publications/pdf/electricgas/DecouplingReport_To_Legislature.pdf. Accessed December 2014.

141 National Action Plan for Energy Efficiency (2009). Customer Incentives for Energy Efficiency Through Electric and Natural Gas Rate Design. Prepared by William Prindle, ICF International, Inc. Accessed December 2014, http://www.epa.gov/cleanenergy/documents/suca/rate_design.pdf.

142 Florida Public Service Commission, Inside the 2014 Florida PSC, April 2014, http://www.psc.state.fl.us/publications/pdf/general/InsidePSC.pdf. Accessed December 2014.

143 Miami-Dade Water and Sewer Department 2014-2015 Residential Water Rate Comparison, http://www.miamidade.gov/water/rates.asp. Accessed January 8, 2015.

144 Whitcomb (2005) found that a minority of Florida utilities printed the rate that was used to calculate each particular bill and none printed the full rate structure that would allow customers to do their own conversions from metered use to dollars billed. Page 3. John B. Whitcomb, Florida Water Rates Evaluation of Single-Family Homes, 2005, http://www.swfwmd.state.fl.us/documents/reports/water_rate_report.pdf

- Water consumption cannot be reasonably reduced beyond a minimal amount for cooking, bathing, cleaning and toilet flushing, and multifamily households have relatively few options for behavioral changes to conserve water.

Despite these problems, there is evidence that water pricing has a significant effect on consumption in Florida, at least in single-family homes. Whitcomb (2005) analyzed data from single family homes for the period 1998 – 2003 in water utility districts across the state with widely varying rate structures. The homes were assigned to one of four groups, representing a range of property values to evaluate the effect of income on sensitivity to the cost of water. Consumption was clearly shown to increase with increasing income (judged by property values), with households in the two highest income groups using more than double the amount of water as those in the lowest income group when water prices were low, less than about $3 per thousand gallons. As the price of water increased to $9 per thousand gallons, water consumption in homes in the 3 lower income groups converged to about 65 gallons per capita per day (gpcd). Even those households in the highest income bracket reduced their consumption significantly, dropping from about 250 gpcd to about 90 gpcd over the price range represented in the data.[145]

A second example of price sensitivity can be seen in water usage profiles reported for a sample of fifteen utilities in the St Johns River Water Management District (SJRWMD). The usage profiles show the percent of each utility's single family residential customers grouped by their average monthly usage in thousand gallons.[146] The water rates for utilities with the largest percent of high usage customers (those using more than 10,000 gallons per month) were among the lowest in SJRWMD. Conversely, the utilities with the fewest high usage customers, had some of the highest water rates in the District.

Both of these examples indicate that increasing water rates can dramatically reduce water consumption in single family homes, with the greatest gains in savings to be realized from mid to upper income households, primarily through reduction of outdoor irrigation. Some of these households may also be changing to an alternative source of water for irrigation. In 2010, an estimated 749 million gallons of groundwater per day were withdrawn from private wells (five percent of the state's total groundwater withdrawals) and 659 million gallons of reclaimed water were used each day.[147] While there is evidence that demand for water use among single-family homes is responsive to higher prices, a much more modest water savings would be expected in multifamily households. Increasing block rates without decreasing the customer base charge would unfairly penalize those whose per-person usage is likely to already be at the low end of the range. A careful structuring of rates is more likely to achieve large reductions. This rate design could keep the base charge very low and steeply increase block rates as consumption rises beyond what is needed for average indoor usage. The design could also keep overall revenue to the utility neutral, with the intent of decreasing water bills for the majority of affected customers.

> *"Occupants and building owners may be unaware of possibilities to increase water efficiency without sacrificing convenience or functionality.*

145 *Ibid.*

146 Castaneda, SJRWMD, Florida Automated Water Conservation Estimation Tool, presentation February 21, 2014, http://www.sfwmd.gov/portal/page/portal/xrepository/sfwmd_repository_pdf/3_2014_waterconsexpo_pres_castaneda.pdf

147 Richard L. Marella, United States Geological Survey. Water withdrawals, use, and trends in Florida, 2010. Scientific Investigations Report 2014-5088, http://pubs.er.usgs.gov/publication/sir20145088. Accessed January 7, 2015.

4.3 State (Florida) water efficiency policies and programs

4.3.1 Statutory water policies

Statutory Water Conservation Policy (Section 373.227, F.S.): "The Legislature recognizes that the proper conservation of water is an important means of achieving the economical and efficient utilization of water necessary, in part, to constitute a reasonable-beneficial use. The overall water conservation goal of the state is to prevent and reduce wasteful, uneconomical, impractical, or unreasonable use of water resources. The Legislature finds that the social, economic, and cultural conditions of the state relating to the use of public water supply vary by service area and that public water supply utilities must have the flexibility to tailor water conservation measures to best suit their individual circumstances. The Legislature encourages the use of efficient, effective, and affordable water conservation measures. Where water is provided by a public water supply utility, the Legislature intends that a variety of conservation measures be made available and used to encourage efficient water use. To achieve these conservation objectives, the state should emphasize goal-based, accountable, tailored, and measurable water conservation programs for public water supply. For purposes of this section, the term "public water supply utility" includes both publicly owned and privately owned public water supply utilities that sell potable water on a retail basis to end users."

Among the requirements for water utilities are: (a) Encourage utilities to implement water conservation programs that are economically efficient, effective, affordable, and appropriate; (b) Allow no reduction in, and increase where possible, utility-specific water conservation effectiveness over current programs; (c) Be goal-based, accountable, measurable, and implemented collaboratively with water suppliers, water users, and water management agencies; (d) Include cost and benefit data on individual water conservation practices to assist in tailoring practices to be effective for the unique characteristics of particular utility service areas, focusing upon cost-effective measures."

Statutory Policy of FPSC regulation of privately-owned water/wastewater utilities: Section 367.011 et seq., F.S.: There are several hundred public water utilities in Florida, as well as 147 privately-owned water and/or waste water utilities that are subject to regulation by the Florida Public Service Commission.

The stated water conservation policy of the FPSC: "Water conservation is vital to Florida's economy. As an economic regulator, the FPSC is actively involved in demand-side water conservation through rates and rate structure review. Rates and rate structure have a direct bearing on water usage and water resource allocation. The FPSC has a Memorandum of Understanding (MOU) with the DEP, updated this year, and another MOU with the five WMDs to coordinate efforts to improve statewide water quality and meet statewide conservation goals. Both agencies provide expert testimony, as necessary, on water quality and conservation issues in rate cases before the FPSC. When feasible, the FPSC allows utilities to recover expenses related to conservation programs and establish conservation rates to reduce water consumption."[148]

Department of Environmental Protection Rules: The pertinent rule is: 62-40.412 FAC. "(1) The overall water conservation goal of the state shall be to prevent and reduce wasteful, uneconomical, impractical, or unreasonable use of water resources. Conservation of water shall be required unless not economically, environmentally, or technically feasible."

[148] Florida Public Service Commission, 2013 Annual Report, http://www.psc.state.fl.us/publications/pdf/general/annualreports/2013.pdf. Accessed December 2014.

Other provisions in the rule include: (c) Requiring efficient use of water. In determining efficiency requirements, the Districts shall consider the effectiveness of efficiency measures already being implemented, including whether a public water supply utility has achieved the per capita water use goal if such a goal is adopted by rule by the appropriate District, and the need for and feasibility of additional measures. Efficiency measures that shall be considered, but not necessarily required of each water user, include" among others, "the use of conservation rate structures wherever practical. A District shall afford a utility wide latitude in adopting a rate structure, and shall limit its review to whether the utility has provided reasonable assurance that the rate structure contains a schedule of rates designed to promote efficient use of water by providing economic incentives. The District shall not fix or revise rates or rate structures. Such rates may be phased in over time." Another relevant provision in this context relates to the "promotion of water-conserving plumbing fixtures and appliances, water efficient landscaping, and automatic rain sensors or soil moisture sensors." (Water Resource Implementation Rule, 2006)

4.3.2 Water Management District policies and programs

The Florida Department of Environmental Protection coordinates closely with the five Water Management Districts operating in Florida on water planning and management issues. The Water Management Districts have their own programs and initiatives and have common programs such as the Florida Water Star Program. They also have water restriction policies.

Florida Water Star Program: This program was developed by the St. Johns River Water Management District in 2006 and became a statewide program in 2012. It adopted standards and guidelines for water efficiency for indoor fixtures and appliances, landscape design and irrigation systems.[149]

South Florida Water Management District: Since 2002, the South Florida Water Management District has provided matching funds of up to $50,000 to water providers for installing low-flow plumbing fixtures, rain sensors, and fire hydrant flushing devices through the WaterSip program.[150]

Southwest Florida Water Management District: Most local governments and utilities within this Water Management District offer up to a $100 rebate to residents who replace inefficient toilets with low-flow models. The District splits the rebate cost with participating local governments and utilities. This District also developed an online water use calculator.[151]

North Florida Regional Water Supply Partnership between St. Johns Water Management District and Suwanee Water Management District: Interactive home water use survey.[152]

[149] See About Florida Water Star, http://floridawaterstar.com/. Access December 2014.

[150] South Florida Water Management District, Water Conservation: A Comprehensive Program for South Florida, September 2008, http://www.sfwmd.gov/portal/page/portal/xrepository/sfwmd_repository_pdf/waterconservationplan.pdf. Accessed December 2014.

[151] Southwest Florida Water Management District, Water Use Calculator, http://www.swfwmd.state.fl.us/conservation/thepowerof10/. Accessed December 2014.

[152] See http://floridaswater.com/waterconservation/survey.html.

Pertinent State Water Conservation Supply Related Law[153]:

a. Section 373.185, F.S. Local Florida-friendly landscaping ordinances:

    1. requires each water management district to "design and implement an incentive program to encourage all local governments within its district to adopt new ordinances or amend existing ordinances to require Florida-friendly landscaping for development permitted after the effective date of the new ordinance or amendment." As part of the specific requirements, these programs must develop standards that result in water conservation as well as water quality protection and specify the maximum percentage of irrigated turf.

    2. prohibits deed restrictions, covenants and/or local government ordinances that restrict or prohibit the implementation of Florida-Friendly™ landscaping on private property.

b. Section 373.62, F.S. This law requires all automatic irrigation systems to use an automatic shutoff device; licensed contractors working on irrigation systems must install or test the devices and, if necessary, repair the shutoff device; and contractors must report any violations to the appropriate authority, or be fined escalating amounts for repeated omissions.

4.4 Third-party above-code programs

Higher levels of efficiency have been spurred by programs designed to create differentiation in the market-place. Builders are able to advertise their projects that have achieved "green" designations. In Florida, even in a year like 2012 which had a relatively low number of new homes built, over 7,000 new homes complied with the ENERGY STAR for Homes program, representing a significant market share. Although most programs don't specifically target multifamily housing, they are included in a number of "green" designations, and organizations offering programs have worked hard to determine methods of allowing multifamily compliance with "green" designation criteria. For example, ENERGY STAR and LEED have tried to include multifamily buildings up to six stories in their residential program even though codes limit residential permitting to three stories. The Florida Green Building Coalition (FBGC) has its own program for high rise multifamily. EPA's WaterSense has a multifamily compliance path applicable to some buildings. Some of these designation programs target only energy or water, but most are multiple-sector in their approach. Some are only applicable to new construction or gut-rehabs because of the level of inspection and replacement required. These programs are summarized in Table 4-1.

[153] The 2014 Florida Statutes, Title XXVIII Natural Resources: Conservation, Reclamation, and Use, Chapter 373, http://www.leg.state.fl.us/Statutes/index.cfm?App_mode=Display_Index&Title_Request=XXVIII#TitleXXVIII

Table 4-1 Summary of third-party above-code programs.

Summary of Third-Party Above-Code Programs			
Name of program	**Administration**	**Local support**	**Type of program**
Water Star	Florida Water Management Districts	Representatives, local utilities	Program designed to save water energy use
WaterSense	US EPA		New home and multifamily buildings designed to save about 20% or more of a typical home water use
Utility energy efficiency programs	Electric and/or gas utility	Utility representative	Varies from slightly better than code to meeting ENERGY STAR.
ENERGY STAR®	US EPA Builder must sign memorandum of understanding (no cost)	Certified Home Energy Rater to evaluate each home—EPA also has sampling and Builder Option Packages programs	See www.energystar.gov for additional information.
Home Energy Rating System (HERS)	Administered by HERS Providers and in compliance with RESNET or other national rating program	Trained and certified energy rater.	Can be used to help qualify for ENERGY STAR and Green designations or be used to compare any residences -new or existing.
Zero Energy Ready Home	US Department of Energy (DOE) Builder must become partner (no cost)	FSEC or other DOE Building America team	Strives for HERS Index of around 50 while maintaining or improving good indoor air quality, durability, and cost effectiveness.
Florida Green Home and Multifamily high rise	Florida Green Building Coalition	Green Home Certifier	Mandatory and credit point system. Has eight categories with many choices: Energy, Water, Lot Choice, Site, Health, Materials, Disaster Mitigation and General.
Green Communities	Enterprise Foundation		Targeted for affordable housing
LEED® for Homes	U.S. Green Building Council	LEED for Homes Providers	Mandatory and credit point system in Energy Efficiency, Indoor Environmental Quality, Water Efficiency, Site Selection, Site Development, Materials Selection, Residents' Awareness, and Innovation.
Zero Energy Homes	US Department of Energy (DOE)	FSEC or other DOE Zero Energy Home team/partner	Demonstration home with net zero energy use because of exceptional energy-efficient design, construction, and appliances combined with renewable energy generation.

4.5 Equipment, appliance and fixture standards

4.5.1 Federal equipment standards

Around 52% of energy use in a Florida multifamily residence is for heating, cooling and hot water.[154] The federal government has been increasing the stringency of the equipment manufactured that performs these functions as shown in Table 4-2. This means that as older multifamily dwellings have these components replaced, they should be more efficient than the older equipment. The only caveat is that the installation of new equipment must be done effectively. For example, central split cooling systems with new refrigerants are best accomplished with new refrigerant lines. Also, a sloppy installation could lead to increased duct leakage. Furthermore, by simply replacing the broken piece of a unit meant to work in combination (outdoor condenser/compressor and indoor air handler), rated efficiencies may not be realized.

Table 4-2 Equipment efficiency levels by year.

Equipment Efficiency Levels by Year				
Popular cooling and heating equipment	**Efficiency parameter (higher is better)**	**1992-2006**	**2007-2014**	**2015-[155]**
Residential central split system air conditioners	Seasonal Energy Efficiency Ratio (SEER)	10	13	14
Residential central split system heat pumps	SEER and Heating System Performance Factor (HSPF)	10/6.8	13/7.7	14/8.2
Non-weatherized gas furnaces	Annual Fuel Utilization Efficiency (AFUE)		0.78	0.80
Popular water heating equipment	**Efficiency parameter (higher is better)**	**1990-2003[156]**	**2004-2015**	**Nov. 2015-**
Gas water heater (40 gallon)	Energy Factor (EF)	0.49	0.594	0.615
Electric water heater (40 gallon)	Energy Factor (EF)	0.82	0.917	0.948

4.5.2 Federal appliance standards

The U.S. Department of Energy establishes minimum energy efficiency standards for more than 50 categories of appliances and equipment accounting for approximately 90 percent of home energy use, 60 percent of commercial building use, and 29 percent of industrial energy use. The DOE's final rules issued in 2013 revised energy conservation standards for residential room air conditioners. In 2014 DOE finalized its rulemaking for testing procedures for residential refrigerators and freezers.[157] Florida's mandatory appliance

[154] FESC modeling of typical multifamily units in Florida, 2014.

[155] Values shown are for the federal standard as applied to Florida. Beginning in 2015 HVAC equipment has regional rules.

[156] Values based on Table 1 in Jonathan G. Koomey, Camilla Dunham, and James D. Lutz, "The Effect of Efficiency Standards on Water Use and Water Heating," Energy Use in the U.S.: A Detailed End-use Treatment, LBL-35475, UC-000, May 1994.

[157] 2014-04-21 Energy Conservation Program: Test Procedures for refrigerators, Refrigerator-Freezers, and Freezers;

standards were last updated in 1993, so federal energy efficiency appliance standards have in all probability superseded them.

4.5.3 Water fixture standards

Water efficiency requirements for new residential plumbing fixtures went in effect January 1994, reducing allowable toilet flush volume to 1.6 gallons, from the 1970s era of 3.5 gallons. Technology continued to improve the efficiency of toilets, but individual states were not permitted to set more stringent standards without permission from the DOE, thus effectively slowing adoption of the more efficient models. The DOE dropped its requirement to approve more stringent water efficiency standards in December 2010.

States have adopted a mix of plumbing codes across the country. Most are based on either the International Code Council's (ICC) International Plumbing Code (IPC), or the International Association of Plumbing and Mechanical Officials' Uniform Plumbing Code (UPC), but some have developed independent State codes or use Home Rule.

> *" . Four states—California, Georgia, Texas and Colorado—have now passed laws adopting WaterSense flow ratings for all new and replacement fixtures*

Currently, Florida uses the ICC as its water efficiency standard. This Code is updated and adopted by the State on a three year cycle subject to review by the Florida Building Commission.

Although there has been no change to the national efficiency regulatory standard, the EPA's WaterSense Certification program for toilets, urinals, showerheads and faucets may become the norm as water shortages continue in many parts of the country. Four states—California, Georgia, Texas and Colorado—have now passed laws adopting WaterSense flow ratings for all new and replacement fixtures. WaterSense toilets use 1.28 gallons per flush and other fixtures are about 20% more efficient than the standards required by the Energy Policy Act of 2005. A total of 173 organizations in Florida, including non-profits, professional and trade associations, government agencies, water management districts and many utilities currently partner with EPA WaterSense.[158] These voluntary standards are widely promoted and fixtures meeting these standards are being used by many water efficiency retrofit programs. The legislatively-approved sales tax holiday held on September 19-21, 2014 applied to both qualified WaterSense and ENERGY STAR products with a sales price of $500 or more. The first $1,500 of the sales price of the products was exempt from the sales tax or local option tax.[159]

While limited in number, multifamily water efficiency retrofits that have been implemented show considerable success. An analysis of a combined energy and water retrofit undertaken in Pennsylvania[160] looked at water consumption data from 71 multifamily properties for 12 months before and 12 months after retrofits done in 2010-2012. Units with prior usage averaging above 80 gallons per bedroom per day

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Final Rule, Regulations.gov, http://www.regulations.gov/#!documentDetail;D=EERE-2012-BT-TP-0016-0045. Accessed December 2014.

158 U.S. Environmental Protection Agency, WaterSense, http://www.epa.gov/watersense/meet_our_partners.html

159 Florida Department of Revenue, 2014 Sales Tax Holiday for new ENERGY STAR and WaterSense Products September 19 through September 21, 2014, http://dor.myflorida.com/dor/tips/pdf/EnergyStar_Tax_Holiday_List_2014.pdf. Accessed December 2014.

160 Baird, et al, Carnegie Mellon University, Energy and Water Savings in Multifamily Affordable Housing, April 2014, http://www.prezcat.org/sites/default/files/CMU%20Energy%20and%20Water%20Savings%20in%20Multifamily%20Affordable%20Housing.pdf

received one of two combination retrofit packages: replacement toilets, faucet aerators and low-flow showerheads, or replacement aerators and showerheads. Units with less than 80 gallons per bedroom per day received only one type of replacement fixture. The percentages in median and average savings for each type of measure are shown in Table 4-3.

Table 4-3 Savings from replacement of water fixtures as part of a Pennsylvania multifamily program. [161]

Savings From Replacement of Water Fixtures			
Fixtures replaced	**Number of units**	**Median % savings**	**Average % savings**
Showerheads	122	0	0
Faucet aerators	616	18%	12.3%
Toilets	599	19%	26.9%
Showerheads and faucet aerators	4,716	11%	12.3%
Showerheads, faucet aerators and toilets	581	36%	31.6%
Total	**6,634**		**16%**

Post-retrofit savings indicated that the combination of low-flow faucets, showerheads and toilets saved the greatest amount of water: a total of 36% over prior median consumption. Water usage was calculated on a per-bedroom basis, which varied widely, as did the amount of water saved after retrofit. Less variation would be likely if the actual number of persons per unit were known. The median water saving is perhaps the most useful indicator for projection to similar multifamily retrofits. Overall, an average water savings of 55 gallons per bedroom per day was achieved. Costs of the retrofits varied greatly, with toilets replacements ranging from $120 to $400 per bedroom, while faucet and showerhead replacements were much less expensive.[162]

4.6 Financing programs (state and local)

4.6.1 Property Assessed Clean Energy (PACE)

The Florida Legislature enacted legislation (House Bill 7179) in 2010 to authorize local governments to enter into property assessed clean energy (PACE)[163] financing arrangements. These agreements authorize local property owners to apply to a local government (subject to and ordinance or resolution) for financing an energy conservation and efficiency improvement or a renewable energy improvement. Energy conservation and efficiency improvements include but are not limited to: air sealing; installation of insulation; installation of energy-efficient heating, cooling, or ventilation systems; building modifications to increase the use of daylight; replacement of windows; installation of energy controls or energy recovery systems; installation of

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161 *Ibid.*

162 *Ibid.*

163 PACE programs are increasingly popular strategy to overcome barriers to financing energy efficiency. See "PACENow" for additional details about the market for PACE: http://www.pacenow.org/about-pace/. Accessed December 2014.

electric vehicle charging equipment; and installation of efficient lighting equipment. Costs incurred by local governments may be recovered through special assessments on property tax bills (not through ad valorem taxes). Loans are linked to the property and not the owner and the obligation to repay the loan transfers with the sale of the property.[164] According to DSIRE, "the benefits of PACE financing include long-term, fixed-cost financing; loans tied to the tax capacity of the property rather than to the owner's credit standing; a repayment obligation that legally transfers with the sale of the property; and potentially a deduction of the repayment obligation from federal taxable income, as part of the local property tax deduction."[165]

In 2011, interlocal governments came together to establish through a charter agreement the Florida PACE Funding Agency. In 2012 the Legislature enacted House Bill 7117 which "expands allowed uses of the local government infrastructure surtax proceeds to provide loans, grants or rebates to residential and commercial property owners who make energy efficiency improvements to their residential or commercial property." [166] This action requires a local government to approve by referendum the expansion of such uses.

> *"Property assessed clean energy (PACE) loans are linked to the property and not the owner and the obligation to repay the loan transfers with the sale of the property.*

4.6.2 Low-interest revolving loan programs

In 2013 the Florida Office of Energy awarded the Florida Housing Finance Corporation a grant of almost $6 million to establish a revolving loan fund called the Multifamily Energy Retrofit Program (MERP). Loans from fund proceeds are used for retrofits of rental properties in older buildings within the Corporation's portfolio. Energy audits are a precondition for loans and must show a 15% projected energy savings. Moreover, the collective energy savings realized from the installed measure must be equal to or greater than the investment cost. As of September 2014, over $7.5 million was available in loan funds. Measures that may be funded from the program include air infiltration such as envelope and duct sealing and weather stripping as well as appliances, lighting, faucets, showerheads, HVAC systems, programmable thermostats, boilers, water heaters, insulation and window film.[167]

Another Florida revolving loan program is the Florida Energy Efficiency Loan (FEEL) program, a $5 million program that provides loans from $500 to $15,000 for energy-efficiency improvements to eligible owners of single-family homes in seven Central Florida counties. Loan pre-approval comes from Fairwinds Credit Union

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164 For a summary of the bill, see Florida House of Representatives, 2010 Session Summary, http://www.myfloridahouse.gov/Sections/Documents/loaddoc.aspx?PublicationType=Session&CommitteeId=&Session=2010&DocumentType=End%20of%20Session%20Summaries&FileName=2010%20End%20of%20Session%20Summary.pdf .Accessed December 2014.

165 The U.S. Department of Energy and the North Carolina Clean Energy Technology Center, Database of State Incentives for Renewables & Efficiency, Pace Financing, http://www.dsireusa.org/solar/solarpolicyguide/?id=26. Accessed December 2014.

166 For a summary of the bill, see Florida House of Representatives, 2012 Session Summary, http://www.myfloridahouse.gov/Sections/Documents/loaddoc.aspx?PublicationType=Session&CommitteeId=&Session=2012&DocumentType=End%20of%20Session%20Summaries&FileName=2012_End_of_Session_Summary.pdf. Accessed December 2014.

167 Florida Housing Finance Corporation, "Request for Applications for Multifamily Energy Retrofit Program: A Florida Housing Finance Corporation Public Meeting," September 15, 2014, http://www.floridahousing.org/FH-ImageWebDocs/Developers/MultiFamilyPrograms/2014-110_MERP/Workshops/2014-09-15/9-15-14%20MERP%20agenda.pdf

(Lady Lake, Florida) with project development and goal-setting assistance provided by IFAS Extension at the University of Florida.[168] Although eligibility for this program applies only to single-family applicants, expansion into the multifamily housing sector is under consideration.

4.6.3 Neighborhood Housing Services Act

The Neighborhood Housing Services Act is a 2014 Florida statute intended to assist local governments in cooperating with the private sector to reverse the decline of housing and neighborhoods. The statute allows public money to be "borrowed, expended, loaned and granted" for the purpose of rehabilitating housing, and appears to include energy efficiency in its scope:

> "It is the policy of this state to provide a necessary means to prevent the deterioration of housing, the decline of neighborhoods and surrounding areas, and the inefficient use of energy and environmental resources associated with such deterioration and decline."[169]

4.7 Low-income assistance programs

Two federal low-income assistance programs, the Weatherization Assistance program and the Low-income Home Energy Assistance Program, provide funding to states to assist low-income households with energy costs.

4.7.1 Weatherization Assistance Program (WAP)

This program is administered in Florida by the Florida Department of Economic Opportunity. The program's mission "is to reduce the monthly energy burden on low-income households by improving the energy efficiency of the home."[170] Funding is subject to annual federal appropriations and is distributed as grants to community action agencies, local governments, and non-profit agencies to provide specific program services for low-income families whose household incomes cannot exceed 200% above the national poverty level. The types of assistance applicable to non-manufactured housing include: air infiltration with weather stripping, caulking, thresholds, minor repairs to walls, ceilings and floors, and window and door replacement; installation of attic and floor insulation (floors in northern Florida counties only), attic ventilation, and solar screens; repairing or replacing water heaters and inefficient heating and cooling units. According to Weatherization Assistance Program guidelines, when at least 66% of the residents of a multifamily building meet the program's income eligibility requirements, resources toward energy retrofits in the building may be applied.[171]

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[168] Florida Energy Efficiency Loan (FEEL) program details at: https://www.fairwinds.org/personal/loans/feel/ and http://www.FloridaEnergyEfficiencyLoan.com. Accessed December 29, 2014. Additional program details provided through personal communication with Hal Knowles, University of Florida Program for Resource Efficient Communities.

[169] Section 420.423, F.S.

[170] Florida Department of Economic Opportunity, Weatherization Assistance Program, http://www.floridajobs.org/community-planning-and-development/community-services/weatherization-assistance-program. Accessed December 2014.

[171] Office of Energy Efficiency & Renewable Energy, Energy.Gov, http://energy.gov/eere/wipo/retrofit-incentives-multifamily-buildings. Accessed December 2014.

Supplements to the Weatherization Assistance Program: "In 1992 the Florida legislature passed the William E. Sadowski Affordable Housing Act. Funding comes from a portion of documentary stamp taxes on deeds and supports two programs that supplement the state's WAP: State Housing Initiatives Partnership, which funds weatherization measures; and the Low-Income Emergency Home Repair Program, which funds emergency and energy-related home repairs."[172]

4.7.2 Low-income home energy assistance program (LIHEAP)

The low-income home energy assistance program is designed to lower low-income household heating and cooling bills through bill payment assistance or weatherization, crisis assistance, or energy-related home repairs. Money is allocated to community action agencies/local councils in each county to be distributed further to energy providers. Household eligibility is 150% of the Federal Poverty Level.

4.8 FDACS Florida Energy Clearinghouse (state)

Section 377.805, F.S. requires the Office of Energy within the Department of Agriculture and Consumer Services, in consultation with the FPSC, the Florida Building Commission, and the Florida Energy Systems Consortium, to develop a clearinghouse of information regarding cost savings related to various energy efficiency and conservation measures. The Department of Agriculture and Consumer Services is required to post the information on its website available at: www.freshfromflorida.com/Energy/Florida-Energy-Clearinghouse.

My Florida Home Energy and My Florida Energy Projects are two interactive tools developed by the University of Florida that can be accessed through the Clearinghouse's portal. My Florida Home Energy enables residents to make their own energy efficiency assessments and receive tips on improving their energy efficiency.[173] My Florida Energy Projects provides a portal for users to access and explore information about ARRA-funded energy-efficiency projects implemented in Florida.[174]

4.9 Florida Green Government Grants Act

Section 377.808, F.S. requires the Department of Agriculture and Consumer Services to use funds specifically appropriated to award grants that will assist local governments, including municipalities, counties, and school districts, in the development and implementation of programs that achieve green standards. The Department is required to determine the green standards and establish "cost-efficient solutions, reducing greenhouse gas emissions, improving quality of life, and strengthening the state's economy." This statute was enacted in 2008 but state funding was never appropriated for the grants. The Department, however, has used federal funds to finance several energy efficiency programs including the Multifamily Energy Retrofit Program administered in partnership with the Florida Housing Finance Corporation. Loans are provided to replace energy inefficient components in properties within the Florida Housing Finance Corporation's portfolio. Energy efficiency improvements must show projected energy savings in energy

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[172] LIHEAP Clearinghouse (Florida), http://liheap.ncat.org/profiles/Florida.htm#federal. Accessed December 2014.

[173] Florida Department of Agriculture and Consumer Services, My Florida Home Energy, http://www.myfloridahomeenergy.com. Accessed December 2014.

[174] Florida Department of Agriculture and Consumer Services, My Florida Energy Projects, http://myfloridaenergyprojects.com/. Accessed December 2014.

audits and following the improvements, properties must report actual savings.[175]

[175] Florida Department of Agriculture and Consumer Services, Office of Energy Annual Report 2013. Available for download at http://www.freshfromflorida.com/News-Events/Press-Releases/2014-Press-Releases/Florida-Department-of-Agriculture-and-Consumer-Services-Releases-2013-Office-of-Energy-Annual-Report-Analysis-of-Economic-Contribution-of-2013-Renewable-Energy-Tax-Incentives. Accessed December 2014.

5. Multifamily Efficiency Best Practices

Six key barriers or challenges to capturing the water and energy efficiency potential in multifamily housing include:

(1) "Split incentives": Property owners who are responsible for decisions to invest in efficiency measures lack incentives to do so because the payoff from that investment is likely to accrue to tenants and not to them.

(2) Information, awareness, and behavior gaps: Consumers might not be aware of or understand their energy or water consumption patterns and their efficiency opportunities. Property owners and managers may not have the necessary data to analyze water and energy use and potential cost savings.

(3) Incomplete and/or unclear price signals: Price signals for water and energy typically do not provide direct and timely feedback. Even if they live in individually metered units, most tenants are not aware of unit prices for water and energy. For water, in particular, the marginal bill savings from conservation and efficiency behaviors may represent a small portion of the overall utility bill.

(4) The "rebound' or "takeback" effect: This effect occurs when gross savings from efficiency improvements are partially or completely offset by increased demand for services provided by the improved equipment.

(5) Cost-effectiveness requirements: The adoption or success of an efficiency program may be constrained by the tests used to establish program cost effectiveness. Utility-based programs that require approval of the regulator have to meet certain cost-benefit tests to justify their implementation. Such is the case for the seven investor-owned Florida electric utilities that are subject to requirements under the Florida Energy Efficiency and Conservation Act. They must subject their proposed energy efficiency measures and programs to cost-benefit tests specified by the Florida Public Service Commission.

(6) Program structure constraints: Challenges are different for utility-based efficiency programs and community-based efficiency programs. For utility-based programs, the regulator must aggregate customer services on a system-wide basis and ensure that the programs do not bias the rate structure in a manner not commensurate with the allocated costs of service. This may mean that locally-based programs targeted to specific types of consumers such as the elderly might face challenges getting Florida Public Service Commission approval. Community-based programs may be better positioned for targeting certain types of consumers but they face at least two challenges: First, their implementation is not centralized making it necessary for a local organization or entity to coordinate them. Second, programs that require significant capital investment may be more difficult to implement than utility-sponsored programs which can recover prudently incurred costs from all the utility's ratepayers.

Five overarching "best practices" should ideally be adopted and integrated with strategies to improve the efficiency of Florida's multifamily properties and to overcome these barriers:

1. build partnerships and coordinate initiatives;
2. promote education, awareness, and behavior change;
3. ensure access to and transparency of data;
4. secure and provide access to financing and incentives; and
5. develop comprehensive program design strategies and implementation frameworks and enforce program provisions.

5.1 Build partnerships and coordinate initiatives

Energy and water efficiency improvement projects, particularly those involving large upfront investments, typically require and are most successful with partnerships between various project participants. Such partnerships are particularly important for overcoming the barrier facing community-based programs which may inherently lack a centralized source of implementation. Networks and alliances may help in overcoming that barrier. For example, Florida's multifamily housing market is represented by the Florida Apartment Association (FAA), which has eleven independent local affiliates and lobbies on behalf of that market. It is a network that can be tapped to increase awareness of efficiency improvement opportunities and through which partnerships with other participants might be established. Another network is the Central Florida Energy Efficiency Alliance (CFEEA or the Alliance), composed of professional and trade organizations, local governments, academic institutions and utilities. The Alliance has in the past offered workshops on topics to improve building energy performance—such as benchmarking—and offers courses to train students to become energy specialists. It is currently in the process of evaluating financing options for multifamily building efficiency.

Existing networks such as the FAA and CFEEA can perhaps contribute to the creation of one-stop shops or organizations to facilitate multifamily efficiency retrofits. Conceptually, one-stop shops reduce the costs of getting the work done and expedite the decision and work flows. They are staffed by and engage knowledgeable people and provide relevant and timely information that helps owners navigate decision-making. An integrated one-stop shop would provide a central point of contact for the building owner. It can build and expand on existing partnerships and resources to coordinate retrofit services to various program participants such as property owners, maintenance and management staff, market program benefits to prospective investors and retrofit candidates, and allocate or assist with distribution of subsidies and financing (see Section 6.5 below).

An often cited example of a successful one-stop shop program is Energy Savers, in Illinois.[176] Energy Savers is a partnership between the Community Investment Corporation and another nonprofit, Elevate Energy. The program provides free energy audits for multifamily residential buildings of five or more units, assists building owners in applying for utility company incentives, helps them secure loans from the Community Investment Corporation, and provides assistance in obtaining contractor bids, monitoring construction, monitoring a building's utility performance and conducting post-retrofit inspections. A cost-benefit analysis of 57 properties in the Chicago area (average property size of 25 units) showed a reduction of 26% in natural gas consumption equal to $195 per unit per year or a 2.8 savings-to-investment ratio.[177] Water and electricity consumption was also reduced but was not part of the cost analysis.

In the absence of one-stop shops, it is easier to overcome barriers to large-scale retrofit investments if there are fewer parties affected by and/or necessary to see through a proposed water or energy efficiency improvement project. For example, projects involving a municipal utility that provides both water and energy services reduces at least some of the coordination challenges that would otherwise exist if two different utilities were involved. Therefore, funding for pilot projects that target efficiency improvements for both water and energy may encounter less of an implementation hurdle if the utility involved provides both

[176] See "Chicago Area Energy Savers Program", American Council for an Energy-Efficient Economy, at http://www.aceee.org/sector/local-policy/case-studies/chicago-area-energy-savers-program

[177] Jon Braman, Steven Kolberg, and Jeff Perlman. June 2014. Energy and Water Savings in Multifamily Retrofits, Stewards of Affordable Housing for the Future, 26, http://www.sahfnet.org/multifamilyretrofitreport_2_1287596736.pdf

water and electricity service. Specifically, there is less of a barrier in obtaining data on energy and water consumption from one utility than there would be from two.

5.2 Promote education, awareness and behavior change

Many of the interviews conducted as part of this study underscored the importance of education and awareness as a critical precondition for bringing property owners to the table to consider efficiency retrofits and ensuring successful project design and implementation. Two strategies to improve consumer awareness include energy audits (a well-established and widely-adopted approach) and communication of energy consumption data in formats that help customers contextualize their own usage in actionable ways (a relatively new/emerging strategy and one that is quickly gaining traction).

5.2.1 Energy audits

Educating or making property owners and tenants aware of the benefits of efficiency improvements can be accomplished through energy and water conservation audits which can be performed by a utility, a third party, or by the owner or tenant. Energy audits are often prerequisites of financing and leasing approaches such as green leasing and PACE programs (Section 5.6.1). HUD also requires public housing authorities to conduct energy audits of HUD-assisted properties every five years. Because residents receive prescribed utility allowances, they may have an incentive to reduce their utility bills.

Whether energy efficiency audits, however, actually spur significant and lasting behavior change is open to debate. A study by Resources for the Future analyzing data from nearly 500 home energy auditors and contractors found that consumers rarely followed up in installing all the audit recommendations. .[178] Follow-up with recommended retrofit measures is often less likely to occur in multifamily housing where the tenant has the interest in such improvements but the property owner—who would have to pay for them—has little interest unless they can capture the direct benefits (the barrier of the split-incentive).

Nonetheless, audits are a valuable and tested tool to generate moderate savings through behavior change and if properly designed they can be an important part of any efficiency program. They can be a catalyst for retrofit activities that do capture deep and lasting energy and water savings. There are ways of improving the impacts of efficiency audits. Audits can include the installation of low-cost energy savings measures, a common strategy employed by utilities. For example, energy audits performed by Florida Public Utilities typically include the installation of ten high-efficiency light bulbs. Therefore, regardless of the direct audit cost to FPU, some benefit will be derived if there is more efficient lighting in the residence. Energy audits might include specific improvement recommendations coupled with information about ways to offset the costs of purchasing and installing efficiency measures. As part of JEA's (Jacksonville/Duval County's municipal electric utility) conservation programs for single-family homes, certified third-party auditors provided homeowners with a list of recommendations including behavioral changes and efficiency retrofit measures together with a list of applicable JEA incentives or rebates for which they are eligible.

Another "best practice" is to analyze whether audits alone actually lead to measurable and significant energy savings. Two Florida examples demonstrate that energy audits appeared to be cost effective. Talquin Electric Cooperative in Quincy, Florida performed a blind pre- and post-audit study, selecting 100 random homes to see if electric consumption went down after energy audits had been performed. The study

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[178] Karen Palmer, Margaret Walls, Hal Gordon, and Todd Gerarden, "Assessing the Energy-efficiency Information Gap: Results from a Survey of Home Energy Auditors", Resources for the Future, RFF DP 11-42, October 2011, www.rff.org/rff/Documents/RFF-DP-11-42.pdf

considered homes where there was a year of electric consumption data before and after the assessment. After controlling for weather, the study found a 2.0% reduction in electricity consumption in homes that had completed audits. The cooperative did not perform a return on investment analysis to see if their direct costs of performing the audits exceeded or fell short of the benefits. A second pre-post impact analysis study[179] measured the savings following professional energy audits of 232 single-family homes as part of the previously referenced JEA demand-side management program. After screening against participation in other JEA efficiency programs and controlling for other factors that could affect electricity use, the study found that program participants saved an average of 3.2% (533 kWh) in the year following the audits.[180] This study also suggested that targeting audits to high users could improve outcomes by as much as 80%.[181]

In summary, audits have proven to be an effective tool to spur significant, albeit moderate energy savings, through behavior change. Although there is uncertainty about how well audits can generate similar impacts in multifamily rental properties, audits are an important tool for identifying the most promising retrofit measures and an opportunity to directly install shallow, low-cost efficiency measures.

5.2.2 Awareness of energy and water use and patterns

There are gaps in information that if filled can improve decision making and lead to more impactful efficiency investments. Best practices should address strategies to make building owners, managers, lenders, and contractors more aware of potential energy and water savings and how to implement projects appropriately to capture savings and optimize return on investments. Several people who participated in stakeholder interviews discussed the importance of and value in reducing information and awareness gaps that hinders multifamily efficiency.[182]

Customers/tenants and efficiency program participants: Various strategies have been developed to increase customer awareness of energy and water use, primarily for single-family homes/households, but these experiences can inform programs to educate multifamily residents as well. Examples include Opower, an independent consulting service that provides customized energy use information—"Home Energy Reports"—to utility customers. Opower Home Energy Reports supplement billing flyers to promote conservation behavior by comparing a resident's energy use to that of his or her neighbors. The program has been adopted by dozens of utilities across the country and average savings have been measured at 2.0% with variability around this average from one utility to another depending on program design (frequency of mailings, targeting of customers, etc.)[183] A conservation representative from Gainesville Regional Utilities (GRU), where the Home Energy Reports program was piloted for three years, cited the potential promise in extending Opower or similar programs to the multifamily market and/or to water programs.[184]

Despite these customer awareness strategies, several experts interviewed for this study, including the GRU representative, noted the difficulty in changing behavior of multifamily renters, particularly in markets with

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179 Taylor, Jones and Kipp. (2014). Targeting utility customers to improve energy savings from conservation and efficiency programs. *Applied Energy*, doi:10.1016/j.apenergy.2013.10.012

180 *Ibid.* page 31.

181 *Ibid.* page 35.

182 These include representatives from a Florida Apartment Association Affiliate; University of Florida Shimberg Center for Housing Studies, an electric cooperative utility and the Cities of Orlando and Gainesville.

183 Allcott. (2011). Social norms and energy conservation. *Journal of Public Economics*. doi:10.1016/j.jpubeco.2011.03.003.

184 Stakeholder interview with Study Team and John B. Whitcomb, Florida Water Rates Evaluation of Single-Family Homes, 2005, http://www.swfwmd.state.fl.us/documents/reports/water_rate_report.pdf

high turnover and/or seasonal populations. Overcoming this challenge will require long-term investments that elevate the value of efficiency and improve market signals to trigger behavior change. Several experts interviewed for this study noted the need for a cultural shift in awareness of efficiency opportunities (and costs of inefficiencies) among the general public to create an "ethic" of conservation and efficiency.[185] Some property owners and management companies embrace this type of environmental ethic and promote efficiency attributes in their multifamily buildings as part of their overall business model.

Conceptually, rate design features such as inclining block rates that price water and electricity to correspond with consumption (the more electricity or water used, the higher the per unit cost of consumption) can signal to consumers that they may be using too much and may have low-cost opportunities to become more efficient and reduce their utility bills. The problem, at least from a conservation perspective, is that average water prices in Florida are low relative to other states' prices, so price signals are weak and customers tend to ignore their consumption and usage variability in their water bills.[186] Moreover, water bills are typically modest relative to energy bills and multifamily buildings tend to be master metered[187] for water, meaning that tenants receive weak and/or incomplete price signals to influence behavior. However, inclining blocks may be more effective for encouraging the conservation of electricity since rental units are more likely to be individually-metered for electricity and inclining rate tiers for electricity are not as incremental (i.e., there are fewer tiers and clearer price-per-unit thresholds).

Information gaps affecting other project participants: Housing policy experts from the University of Florida's Shimberg Center for Housing Studies noted that for any multifamily efficiency program to be successful, one has to convince the property owners that efficiency retrofits are worthwhile investments. They need to be made aware of the potential financial returns, including those generated directly and indirectly by energy and non-energy benefits of efficiency. Access to information and resources needs to be made easy as a precondition for their willingness to invest in rental property improvements. Benchmarking the baseline energy or water-efficiency levels of a multifamily property being considered for a retrofit is an important strategy for making that business case.

5.3 Benchmark performance

A method of comparing the energy performance of a given property to that of other similarly situated properties (benchmarking) can provide building owners with potentially useful information and perhaps overcome their resistance to making large capital outlays for retrofit projects. Benchmarking tools should be easy to use and access at no cost to the user, and they should also make use of data that are standardized to allow for comparisons across different buildings' energy and water performance.

Benchmarking has been adopted as a best practice in various programs such as multifamily programs under the auspices of the New York State Energy Research and Development Authority (NYSERDA) and the Massachusetts Low-Income Energy Affordability Network (LEAN).[188] The NYSERDA Multifamily Performance Program provides financing for retrofits of existing multifamily housing and for new construction. Projects undertaken in the program must realize an energy savings of at least 15%. LEAN and its advisory committee

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[185] Interviews with an author who specializes in national water conservation and behavior change and two Florida municipal utility conservation representatives.

[186] Stakeholder interview with a water resources economist at the University of Florida who studies water pricing, rate design and conservation programs.

[187] Customers are not metered individually, but their consumption is aggregated with other customers and their bill is determined through a formula.

[188] ACEEE, "Recommendations and Best Practices for Benchmarking Multifamily Buildings," Policy Toolkit, May 2014.

> *Benchmarking tools enable property owners to identify the best opportunities for energy-efficiency improvements and to set priorities for the purchase and installation of retrofit measures.*

oversees the Massachusetts Low-Income Multi-Family Energy Retrofit program which is sponsored by Massachusetts' electric and natural gas utilities.

Benchmarking is a simple method of helping property owners to understand how their buildings use energy or water and to pinpoint the underlying causes of inefficient use. It also allows consumers to compare their usage to others in similar homes and make them more aware of opportunities to use less. Benchmarking is important for providing context to the consumption data that building owners and customers receive from their utility. The data needed for benchmarking to derive costs and benefits that result in the payback calculations must be collected from utility companies (e.g. energy and water consumption, billing records, demand-side management information). The data also must include multifamily property characteristics and operations and metering configurations (typically from property appraiser and geocoded utility infrastructure and customer data). Benchmarking outcomes enable property owners to identify the best opportunities for energy-efficiency improvements and to set priorities for the purchase and installation of retrofit measures. Benchmarking is also of interest to lenders who want to ensure that their investments will actually lead to energy and water bill savings.[189]

Benchmarking tools are under development or already available to facilitate comparisons of building efficiency performance that, in turn, would inform property owners' investment decisions. Such tools include the EPA ENERGY STAR score for multifamily buildings, which was developed by Fannie Mae in partnership with the EPA and released in the Fall of 2014,[190] the EZ Retrofit Tool, which was developed by Stewards of Affordable Housing for the Future and allows site-specific and flexible options for property owners to identify the most cost-effective retrofit measures,[191] and Orlando's emerging Data Access Platform[192] that is part of its City Energy Project.[193] Another market-based approach is to provide tenants with online, open-access tools to compare apartments' actual energy and/or water use and bills, such as Tools for Tenants, targeted to Gainesville, Florida renters.[194] The underlying idea is that if demand exists for

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189 Erika Schnitzer, "Measuring Up," January 2011, http://www.mydigitalpublication.com/publication/?i=56374&p=35

190 Fannie Mae, "Transforming Multifamily Housing: Fannie Mae's Green Initiative and ENERGY STAR for Multifamily," September 2014, https://www.fanniemae.com/content/fact_sheet/energy-star-for-multifamily.pdf. "The 1 – 100 ENERGY STAR score for multifamily properties makes it easy to understand a property's energy performance compared to its peers and to better assess the relative risk of each property. Properties receive a score on a scale of 1 to 100, which accounts for the property's energy use across fuel types and normalizes for weather, building characteristics, and business activity. This score represents the property's percentile ranking compared with similar properties. For example, a property with a score of 25 performs better than only 25% of other similar buildings, but a property with a score of 75 performs better than 75% of its peers. In addition, properties with scores of 75 or higher are eligible to earn the ENERGY STAR certification, which is America's symbol of top energy performance." at page 2.

191 Stewards of Affordable Housing for the Future (SAHF), "Energy Conservation: The EZ Retrofit Tool", http://www.sahfnet.org/ezretrofit.html and Stakeholder Interview with SAHF representatives.

192 City of Orlando, "Orlando's City Energy Project Plan (draft)", provided by Chris Castro, Community Energy Program Manager, Senior Energy Adviser, Institute of Market Transformation, City Energy Project.

193 This is a national initiative of the Natural Resources Defense Council (NRDC) and the Institute for Market Transformation (IMT) to reduce energy waste in large commercial buildings (including multifamily): http://www.cityenergyproject.org/. Orlando is one of ten cities participating in the initiative http://www.cityoforlando.net/greenworks/cep/

194 This program was developed by EnergyIT and the University of Florida Program for Resource Efficient Communities,

more energy-efficient apartments, property owners will have incentives to make efficiency investments.

Benchmarking also provides the basis for architectural specifications and assessments of the performance of fixtures and appliances. For example, Minnesota developed criteria for meeting water fixture requirements. Those criteria can be used as the basis for testing whether the flow rates of installed water fixtures have been reached. According to Minnesota Green Communities, the criteria are needed because "contractors aren't accustomed to confirming plumbing flow rates, and product specifications don't always predict production function."[195]

5.4 Ensure access to and transparency of data

Ensuring access to and transparency of utility consumption data is essential for successful program design and implementation. One of the challenges facing property owners and managers is that they may not have the necessary data to analyze water and energy use and potential cost savings. Before a retrofit measure is installed, the property owner will want to know what retrofit measures are needed, how much the measures cost, and be given assurances by the contractor of how much energy and money will be saved with the installation (the pay-back). Because energy-efficiency projects in multifamily buildings can be very costly, property owners will be more likely to proceed if they understand their buildings' energy efficiency performance and the risks of making such investments.

Benchmarking performance to assess savings opportunities requires good usage data, and access to those data can be problematic particularly if owners do not receive tenants' utility bills (as is often the case in Florida with electric bills). Owners either can request individually-metered usage data from tenants or utility companies can provide data to building owners or managers in a form that protects tenants' privacy. Utilities that provide data in such a form, for example, include ComEd in Chicago, PEPCO in Washington DC, Puget Sound Energy in Washington, and Austin Energy.

In addition, there may be issues with coordination of utility data gathering if more than one utility is involved in an efficiency program. Coordination issues may arise if, for example, both energy and water utilities need to provide energy consumption data before or after efficiency measures are installed so that the energy savings can be measured and verified. Memoranda of understanding may be one approach to dealing with coordination challenges: they can specify the responsibilities of each utility and partner in the data disclosure initiative. This was a "lesson" reported by Austin Energy in assessing its Multifamily Energy and Water Efficiency Program.[196] If a third-party entity (and not the participant utility) is required to analyze the savings, some sort of agreement needs to be developed to provide the third-party with usable utility data.

Data transparency is also critical for green leasing contracts, which are energy-efficiency leases designed to include efficiency concepts. All measures of a building's efficiency performance must be transparent and energy consumption data should be shared by owners and tenants; that provision may be included in the lease itself.

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funded through an ARRA grant and sponsored by FDACS, Gainesville Regional Utilities, the City of Gainesville, and the U.S. Department of Energy's Small Business innovation grant program. See http://www.toolsfortenants.com/about. Accessed December 9, 2014.

[195] Minnesota Green Communities, "Water Efficiency," http://mngreencommunities.org/publications/download/lessons/WaterEfficiency.pdf. Accessed December 9, 2014.

[196] Rachel Young and Eric Mackres, "Tackling the Nexus: Exemplary Programs that Save Both Energy and Water," ACEEE, Report No. E131, January 2013, pp. 64-68.

5.5 Secure and provide access to financing and incentives

Financing is central to efficiency improvements, particularly those involving large upfront capital expenditures. Efficiency improvement projects need to be included in financial transactions affecting major renovations in multifamily buildings. Financial "best practices" will depend on the type of housing—subsidized or not subsidized. If the financing is needed for subsidized or affordable housing, long-term financing should be structured so that borrowed capital for efficiency improvements has a projected payback that is aligned to the anticipated timetable for realized energy savings. Financing must also take into account the type of subsidy and the nature of the efficiency upgrades for each property.

> *"Financing is central to efficiency improvements, particularly those involving large upfront capital expenditures.*

There are several financing models that may be appropriate for energy and water efficiency improvement projects depending on the individual circumstances:

- Community investment corporation funding model. For example, the Community Investment Corporation is a not-for-profit lender to properties of five or more units in Chicago. It provides affordable financing in the form of fixed-rate, fully amortized loans of up to seven years for energy improvement projects. The Community Development Corporation partners with Elevate Energy, another nonprofit organization that provides technical support to the program and retrofit project partners. Together these organizations form the program Energy Savers, a one-stop shop referenced in Section 5.1.
- Use of on-bill loan programs for master-metered buildings. Specifically, this financing mechanism can be used without triggering complicated loan requirements. It provides utility customers with loans that are repaid through monthly charges on their utility bills, with payments roughly in line with average expected bill savings. The Hawaii Public Utilities Commission is currently reviewing a program manual to establish and implement on-bill financing for lower income customers.[197]
- Property assessed clean energy (PACE) financing. As noted in 4.6.1, PACE financing is authorized by Florida statute and is an option for multifamily housing. For example, the St. Lucie Board of County Commissioners partnered with a Community Development Financial Institution (SELF) to create and administer a PACE program. Property owners of commercial, industrial, nonprofit and multifamily buildings can apply for upfront financing under the program. For its part, SELF will operate an energy retrofit loan program, provide energy expertise, and assume a project management role. The line of credit will come from an affiliate Inland Green Capital, which invests in PACE programs nationwide. The new program also provides an example of the one-stop shop concept.
- Point-of-sale/Residential Energy Conservation Ordinance (RECO) financing. The RECO model is generally triggered by the sale or refinance of a property and is a means of improving energy and water efficiency when the property fails to meet minimum standards at the time of transaction. The federal government established a program that incorporates the RECO model with its initiation of the Energy Efficient Mortgage (EEM) program administered by the Federal Housing Administration (FHA) and Veterans Administration. The FHA insures the mortgage loans to encourage lenders to make loans to residents who would normally not qualify for traditional loans. In addition, cities can

[197] Docket No. 2014-0129

pass ordinances that enable RECO financing arrangements.[198] There are presently no examples of adopted RECOs in Florida, but there is an initiative underway in Gainesville to design and propose a city RECO. The effort is being led by Gainesville Loves Mountains and with technical assistance and research being conducted by the University of Florida, Levin College of Law Conservation Clinic. At least half a dozen cities in other states have established RECOs, including Boulder, CO (see reference to Boulder's Property Maintenance Code in Section 4.1.3), Ann Arbor, MI, Berkeley, CA and San Francisco (see reference to that city's ordinance in 4.1.3.). Typically, the ordinance includes a list of energy efficiency and water conservation measures that must be installed and requires an inspection to verify that such measures have been properly installed. The funding for efficiency improvements is generally provided by the seller and incorporated into the sales price of the property.

- Energy Service Company (ESCO) financing. An ESCO provides financing for energy-efficiency projects over a seven to 20 year period. The building's tenants or property owner repays the project costs through savings generated from the efficiency improvements. An ESCO develops the program and bears the technical and performance risks connected with projects. ESCO-type contracts are statutorily authorized for state and municipal agencies and political subdivisions in Florida.[199]

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[198] U.S. Department of Housing and Urban Development, "Energy Efficient Mortgage Program," http://portal.hud.gov/hudportal/HUD?src=/program_offices/housing/sfh/eem/energy-r. Accessed December 17, 2014.

[199] See Section 489.145, F.S.

6. Multifamily Efficiency Program Recommendations for Florida

6.1 Summary of context for recommendations

In the previous sections, we summarized existing Florida policies, programs and codes that provide incentives for property owners to invest in the efficiency of their multifamily rental properties and we evaluated successful multifamily efficiency initiatives in other states. Based on that discussion we recommend and describe in this section specific efficiency retrofit programs/projects that can be adopted quickly and launched rapidly along with long-term strategies to improve the synergies between and scope and scale of program impacts. We set the stage for these specific project recommendations by first summarizing key points and take-home messages from previous sections of this report.

6.1.1 Incentives, disincentives, and challenges facing stakeholders in the market for efficiency retrofits to multifamily properties

Before any successful multifamily efficiency program can be designed and implemented, one must understand the incentives and disincentives of key players to participate in programs. The incentives are the potential energy and water savings and attendant non-energy/water benefits, which may be significant. Based on modeled per-unit energy and water savings potential and depending on the age of the units and level of retrofit, a 10,000 unit efficiency retrofit project could yield total annual savings of between $2.1 million and $8.1 million. Yet the market for multifamily efficiency retrofits is very complex and difficult to penetrate, particularly where landlords see little potential benefit from efficiency investments where they expect tenants to reap the immediate benefits (the persistent “split-incentive” problem). The disincentives are that property owners and tenants may not appreciate, be convinced of, or—for a variety of reasons—be able to realize potential savings associated with efficiency projects. Program recommendations address several fundamental challenges to advancing energy and water efficiency in Florida’s multifamily rental dwellings:

- Marketing efficiency benefits to property owners and bringing them to the table so that they are engaged in conversations about retrofit opportunities and can begin to consider making the investments. This effort may be more problematic if property owners live far from the property being considered for retrofits (i.e., the owners are not local or “community-based”).
- Effectively and efficiently providing, coordinating, and leveraging resources for access to financing in support of retrofit activities and investments.
- Reaching the property owners and tenants who are likely to benefit the most from efficiency upgrades, coordinating program design and implementation with partner utilities, using historical consumption data to benchmark efficiency performance, and targeting efficiency measures and incentives to properties/buildings/units with the greatest need and/or savings potential.
- Optimizing retrofit outcomes by capturing energy and water savings and ancillary benefits at scale and in a cost-effective manner.

- Ensuring appropriate mechanisms for measuring and verifying efficiency retrofit outcomes and sharing results and lessons learned with those responsible for program decision-making, design and implementation processes.

6.1.2 Attributes of Florida's existing multifamily efficiency programs

Most existing Florida multifamily energy and water efficiency initiatives have the following attributes:

- They are few in number due to the complexity of operating in this marketplace and the lack of market incentives for multifamily landlords to make efficiency investments—the "split incentive" problem;
- They have been implemented relatively recently or are still in pilot phase and many were launched with stimulus funds from the 2009 American Recovery and Reinvestment Act (ARRA);
- They are relatively narrow in scope and/or emerging in program design due to statutory, program, financial or other technical and logistical constraints;
- They have demonstrated varying degrees of "success" as measured by program participation, retrofit measures installed, and energy and water savings, and
- They could benefit from additional dedicated resources and focused study to fill information gaps and improve overall program design, implementation, and outcomes.

6.1.3 An integrated approach for Florida's multifamily efficiency programs

To address the range of challenges and opportunities to capture energy and water savings in Florida's multifamily housing stock, multifamily efficiency programs must be integrated and comprehensive in design strategies, implementation frameworks and enforcement/follow-through provisions. An interview with representatives from the National Housing Trust (NHT) and the Natural Resources Defense Council (NRDC) outlined several practices that are important for ensuring the success of multifamily efficiency policies and programs. These best practices are augmented by others based on stakeholder interviews and the literature review that was part of the study.[200] Together, they directly informed development of the study team's program recommendations:

- Strategically target subsets of the multifamily housing market (e.g., subsidized/assisted properties; affordable housing; older, inefficient buildings; geographic regions/utility service areas with high densities or concentrations of multifamily rental properties; master-metered buildings; owners with large portfolios of multifamily properties). Building- and unit-level attributes when merged with utility consumption data can be used to inform investment decisions that maximize energy and water savings and improve program cost effectiveness. With respect to the efficiency of housing for low-income populations, the Florida Public Service Commission in the goal-setting proceedings wanted electric utilities subject to the Florida Energy Efficiency and Conservation Act to offer energy-efficiency programs for that population. The Commission received some assurance that low-income programs would be considered for the next phase of the FEECA goal-setting cycle.[201]

[200] Particularly from resources such as the Natural Resources Defense Council Fact Sheet "Energy Efficiency for All," and the ACEEE report, "Apartment Hunters: Programs Searching for Energy Savings in Multifamily Buildings."

[201] Florida Public Service Commission, "In the Matter of Commission Review of Numeric Docket No. 130199-EI Conservation Goals (Florida Power & Light Co.; Docket No. 130200-EI (Duke Energy Florida, Inc.); Docket No.

- Structure incentives to encourage whole-building retrofits rather than the installation of individual conservation measures, which in isolation can achieve only a limited scope of benefits. The greatest savings are likely to be captured from whole-building approaches that include efficiency measures for both common areas and individual units/apartments.
- Incentives should be calibrated to performance outcomes and should be known to both owners and investors at the outset of the project (even if incentives are based on modeled rather than measured savings).
- Coordinate efficiency upgrades involving both electric and water utilities and efficiency measures to the greatest extent possible. This strategy reduces the burden on property owners interested in making large-scale improvements, can achieve a greater level of savings and better return on investments, and prove less disruptive to tenants. Municipal utilities such as OUC, JEA, GRU, and TalGov are particularly well positioned to provide coordinated energy and water efficiency retrofits. They deliver both energy and water services and have direct access to the consumption data and billing records from both types of services. That information can be used to inform program design and target program marketing to customers likely to benefit the most from participation in efficiency improvement initiatives.
- Establish alternative financing options and flexible pathways for improving energy and water efficiency. Certain programs and financing methods are more suited to measures with short-term payback horizons whereas other more complex projects involve more participants, more sophisticated financing models, greater project risk, and longer-term payback horizons. For example, projects suitable for on-bill financing might involve capital costs as low as $5,000, whereas Energy Service Company (ESCO)-financed projects average $1-$3 million.[202] Once tenants or property owners have implemented less costly upgrades that quickly lead to utility bill savings, they may be more likely to tackle efficiency improvement projects with higher up-front costs.
- Create "one-stop shops" for project participants, resources and partners. A streamlined approach can accommodate both efficiency improvement projects with short paybacks as well as larger scale projects with long-term paybacks.
- Reach the multifamily housing sector and low-income, cost-burdened households through market participants (e.g., Weatherization Assistance Program partners, Florida Housing Finance Corporation properties, and Low-Income Housing Tax Credit properties), especially for rehabilitation projects. Involving owners, property managers, real estate brokers, lenders, local banks and contractors early in the project planning phase is critical to the success of efficiency retrofit projects.
- Ensure that the timing of efficiency program marketing and interventions is coordinated with key property owner decision points, such as regular property operation and maintenance schedules,

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130201-EI (Tampa Electric Co.); Docket No. 130202-EI (Gulf Power Co.); and Docket No. 130203-EM (JEA)", Docket No. 04301-14 (August 8, 2014), Vol. 7, p. 118. Commissioner questions regarding energy efficiency programs were raised several times during the proceedings. For example, Mr. Butler, FPL, stated: "You know, while we currently offer some programs targeted to low-income customers, we intend to go back and assess what additional measures for low-income customers could be introduced as part of a new or existing program, and that's something that we would submit as part of our proposed plan once you've set goals for FPL and the other utilities."

202 Casey J. Bell, Stephanie Sienkowski, and Sameer Kwatra, "Financing for Multi-Tenant Building Efficiency: Why This Market Is Underserved and What Can Be Done to Reach It," American Council for an Energy-Efficient Economy, August 2013, p. 13.

major renovation or rehabilitation investments, point-of-sale financing, refinancing, other program certification activities, and/or property owner license renewals (where applicable).

- Implement quality-assurance mechanisms for the selection of contractors, efficiency audits, rating processes, project inspections, and measurement and verification of cost-savings reported in efficiency audits.
- Enforce the building codes that are in effect. A representative of the Florida Refrigeration and Air Conditioning Contractors Association, interviewed as part of this study, thought that enforcing existing building codes would result in greater energy savings than could be realized by any new programs.
- Showcase programs that have been successful in Florida for providing incentives to property owners to make upfront investments with longer payback periods. Examples include OUC's Multifamily Custom Incentive Program[203] and the Florida Water Star certification program**.**

6.1.4 List of specific recommended multifamily efficiency initiatives

We recommend eight specific program and policy initiatives that incorporate features of the integrated approach addressed above to improve the energy and water efficiency of Florida's multifamily housing stock by providing incentives for landlords to invest in retrofit activities:

1. Implement a pilot program/demonstration project that tests innovative code enforcement mechanisms. The intent of such a program or project would be to strengthen the impact of existing code provisions for energy and water efficiency.

Implement a time-of-transaction efficiency (TOTE) or point-of-sale efficiency (POSE) pilot program/demonstration project. Such a program should be designed to reach multifamily properties with retrofit opportunities that coincide with key property maintenance/transfer and landlord decision-making processes.

Implement a pilot program/demonstration project that uses market-driven tools to publicize and market housing costs in terms of average rents plus average utility costs. That information can be used to inform owner, renter, and third-party decisions about retrofit opportunities and efficiency investments.

Create a one-stop shop (statewide and/or local, community-based) that would streamline the process of planning, implementing, financing and ensuring the quality of an efficiency retrofit investment.

Implement a pilot program/demonstration project that targets efficiency retrofit measures to specific market segments (using benchmarking best practices). Such a program or project would benchmark current energy and water efficiency/performance and target specific owners, properties, buildings, and/or units with retrofit opportunities to capture deep, cost-effective and scalable savings.

Develop and deliver new education and awareness programs designed specifically for multifamily property owners, managers, and maintenance staff. Such programs would leverage existing continuing education

[203] Orlando's Multi-Family Custom Incentive Program was funded by federal stimulus money through the FDACS Office of Energy and implemented in collaboration with University of Florida partners. It provided grants of up to $130,000 per property to make properties more energy efficient. To be eligible for funding building complexes had to be at least 15 years old and owner had to be willing to retrofit at least 50% of the building units and share data to support the performance of the retrofit projects. Funding is no longer available through this program.

infrastructure and resources while expanding their reach and content to explicitly include multifamily energy and water efficiency.

Provide funding for pilot programs that include as part of walk-through audits the installation of efficiency measures with short payback periods (i.e., "shallow" measures or "rapid-return" retrofit packages).

Develop and pilot test an on-bill financing program to increase access to financing in support of retrofit activities/investments. To increase program success, provide funding to utility partners so that they can couple rebates with low-interest revolving loan fund incentives for property owners.

6.1.5 Time horizons for recommendations

Recommendations are either near-term or long-term in program implementation and/or in realizing a return on investment. These terms are:

> *"Coupling short-term multifamily efficiency programs and projects with long-term investments will ensure greater overall program success: improving the cost-effectiveness of any single program; facilitating capture of deeper, scalable energy and water savings, and capitalizing on the promise of synergies between "rapid-launch" programs.*

Near-term, focused opportunities/action items: Each program recommendation is tailored to leverage existing opportunities (program frameworks, partners and tools, etc.) and be effective in the near-term given existing constraints that potentially limit the program scope, scale and/or the realization of benefits. Constraints include information gaps, staff shortages or a lack of dedicated funding for program implementation and follow up. For each of these "rapid-launch" recommendations and associated near-term action items, we discuss the program goals (*what* is it intended to accomplish?), purpose (*why* is it important?), authorities and entities involved (*who* should be engaged to ensure success?), design and implementation features and pathways (*how* are the program goals achieved?), and target regions/markets for participation (*where* should retrofit projects be implemented to capture the greatest energy and/or water savings?).

Long-term, comprehensive opportunities/action items: For recommendations of certain initiatives that require a long time-horizon to implement and recover investment costs, we include a brief discussion of required strategic program action items and/or necessary changes to Florida's existing statutes, regulations and codes. These initiatives address institutional and market challenges that can be overcome only with significant stakeholder buy-in and subsequent policy and program investments. The discussion of these initiatives also addresses policy and program features that would be effective in promoting and facilitating the success of efficiency activities not only within—but also beyond—the marketplace for multifamily energy and water savings.

Overall/strategic approach: Coupling short-term multifamily efficiency programs and projects with long-term investments will ensure greater overall program success: improving the cost-effectiveness of any single program; facilitating capture of deeper, scalable energy and water savings, and capitalizing on the promise of synergies between "rapid-launch" programs. Because of this, we encourage Florida's legislators, regulators and program administrators to pursue "rapid-launch" and "long-term" project recommendations in concert with one another rather than in isolation. While statutory and rule changes are not quickly implemented, this integrated and strategic approach to multifamily efficiency policy and program planning is likely to improve energy and water efficiency. At the same time, such an approach can contribute to enhanced property value, and potentially reduce cost burdens on tenants of Florida's multifamily rental properties.

6.2 A description of each multifamily efficiency initiative recommendation

Recommendation #1: Pilot innovative code enforcement mechanisms to improve compliance (near-term) and strengthen efficiency provisions through code changes (long-term).

What?

A few code improvement and enforcement measures could contribute to improved water and energy efficiency in Florida's existing multifamily buildings. This recommendation addresses both a near-term goal and a long-term goal related to building codes and their implementation.

Near-term goal: to improve compliance with code-minimum standards that apply to multifamily properties with innovative enforcement strategies.

Why?

Several Florida practitioners interviewed for this study stated that more progress could be made by enforcing existing efficiency provisions "already on the books" than through any new efficiency program.

How?

Implementing this type of program would entail explicit coordination of state and local multifamily efficiency initiatives and programs with local permitting and code enforcement procedures and staff. The goal is to improve documentation of the base efficiencies of existing energy and water systems, equipment, appliances and fixtures and identify cost-effective and/or code-required retrofit opportunities. This type of coordination to improve code enforcement is particularly important for properties built prior to the most recent energy and water code changes. A specific strategy to identify multifamily developments and/or buildings that may not be meeting code standards is to consolidate and systematically evaluate permitting data with utility consumption data and property appraiser records. This complements Recommendation #7: benchmarking and targeting.

McKinsey & Company (2009) discusses specific measures to improve compliance with building codes. These include: "1) managing performance of building inspectors with third-party verifiers to spot-check buildings, 2) hiring more building officials, 3) increasing the pay of building officials and requiring training in building science to attract those with building assessment skills; and 4) increasing the objectivity of performance-based code compliance, particularly for energy modeling." [204]

Who?

Local jurisdictions make enforcement decisions. If the legislature could find a source of funding to help the local jurisdictions to fund this effort, that would be beneficial. Alternatively, there could be an incentive to have a third party inspect systems to verify compliance and/or identify code violations. Local jurisdictions

[204] McKinsey & Company. (July 2009). Unlocking energy efficiency in the US economy. New York. Page 45, http://www.mckinsey.com/client_service/electric_power_and_natural_gas/latest_thinking/unlocking_energy_efficiency_in_the_us_economy. Accessed November 2014.

have many portions of the code and may not inspect the energy, water and mechanical equipment to the level desired to overcome problems mentioned by stakeholders.

Long-term goal: to strengthen existing energy- and water-efficiency code provisions as they apply to multifamily properties and equipment replacement.

Why?
To capture additional cost-effective savings opportunities in existing and new multifamily housing.

How?
Code changes require a long-term time horizon because they typically go through the following procedure before they become effective:

- A three-year cycle for new building codes.
- Notices and meetings as part of the Florida Building Commission process.
- Potential overruling by the legislature if industries lobby sufficiently.
- Education of local officials of code changes.
- Local implementation of codes by often overstretched staff.

Proposed code changes that should lead to energy savings include:
Program provisions: The program should enforce permitting for complete HVAC system change-outs, require that HVAC change-outs only be performed by licensed contractors, and require that change-outs of refrigerant lines be made per manufacturer's instructions. This would require code changes (state) and enforcement (local).

Mechanical ventilation system testing: Mechanical ventilation systems in multifamily housing must be tested and either positively pressured or balanced at times of any permit related to mechanical systems.

Gut rehabilitation and new construction standards: Similar to what is required in the Montana Housing Rehabilitation Standard[205], require that multifamily residential gut rehabilitation or new construction of up to three stories meet the ENERGY STAR Qualified New Homes standard, and multifamily housing gut rehabilitation or new construction of four or more floors meet American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) Standard 90.1-2004, Appendix G plus 20 percent. Require that other rehabilitation projects (less than full rehabilitation) use ENERGY STAR labeled components and appliances when ENERGY STAR alternatives are available. Also include water efficiency requirements for toilets, showers, and faucets such as WaterSense labeled.

Who?
The legislature can direct the Florida Building Commission to consider these changes as part of the next code update.

[205] *Montana Department of Commerce Annual Action Plan NSP Amendment.* (2011). Montana Department of Labor and Industry: Building Codes Bureau. Retrieved from http://comdev.mt.gov/content/NSP/docs/NSP3Documents/NSP3Amendmenttoactionplan/housingrehabstandards

Recommendation #2: Implement a time-of-transaction efficiency (TOTE) or point-of-sale efficiency (POSE) pilot program and demonstration project.

What?

Description of pilot project: The state might partner with a local (city or county) government and utility to offer a pilot program or demonstration project that aligns the schedules for marketing efficiency retrofits with regular property maintenance/transfer and landlord decision-making processes and that generates preliminary data on program efficacy and implementation needs.

How?

Models: Use the residential energy conservation ordinance (RECO) model to inform time-of-transaction strategies and programs: Ann Arbor, Michigan's RECO was noted as a model being used to draft an Energy Conservation Ordinance (ECO) for the City of Gainesville.[206] Where available, financing mechanisms such as PACE with any RECO or time-of-transaction efficiency initiative should be integrated with time-of-transaction strategies. The program should ensure that appropriate retrofit measures/packages, financing and decision tools are available for use by decision makers at the time of transaction (consistent with Recommendations #4 and #8).

Timing strategies: Incentives might be provided to encourage the development of strategies that would enable time efficiency interventions to coincide with key landlord decision points and opportunities. Key market decision points for multifamily rental property owners include: point-of-sale, transfer, finance, refinance, retro-commissioning, redevelopment, rehabilitation (for gut rehab provisions, Montana's "Housing Rehabilitation Standards" serve as a useful model), renovation (requiring a permit), program subsidy or eligibility certification (e.g., HUD property renewals), and landlord licensing or renewal.

A long-term strategy to improve the effectiveness of such timing strategies would be to expand statewide requirements for landlord licensing to apply to multifamily rental property owners, or owners of properties with a certain number of multifamily rental units in Florida. This landlord licensing standardization (minimum criteria) for multifamily property owners would require legislative action to adopt revisions to Florida's Landlord/Tenant Law (Chapter 83, Part II) and fill gaps in local implementation where licensing is required only for owners of renter-occupied single-family homes and condominiums, for example. Local governments (city and county) with authority over landlord licensing would be responsible for implementing and enforcing the new multifamily rules. In the absence of multifamily landlord licensing requirements and regular license renewal criteria and cycles, the windows of opportunity to implement time-of-transaction programs—to confirm compliance with established performance thresholds—are limited. Changes to minimum landlord licensing requirements would require legislative action, administration by state agencies (e.g., Florida's Department of Business and Professional Regulation), and implementation by local governments.

Trigger for requiring efficiency improvements/retrofits: This type of efficiency program should establish energy and water efficiency performance thresholds and—at time-of-transaction—conduct an audit or alternative method of assessing efficiency performance (whole building rating system, for example), and require properties not meeting these thresholds to meet base code efficiencies through retrofits. Another option is to require new properties to meet ENERGY STAR or WaterSense standards (see GA and a few other states as model for similar water standards). Benchmarking tools such as the ENERGY STAR Score for

[206] Stakeholder communication; Gainesville Loves Mountains and University of Florida Law School student.

Multifamily Housing and the EZ Retrofit Tool and/or other models that use actual energy and water consumption data should be used to determine appropriate performance thresholds.

Financing: The amount and type of financing of required improvements will vary, but should include a cap (either fixed or as a percentage of property value). Property owners (or buyers in the case of sale or transfer of property) are typically responsible for covering equipment and installation costs. These costs can also be folded into the transaction, for example with PACE mechanisms and/or on-bill financing through utility bill savings (Recommendation 8). Program costs are typically modest for RECOs and can be recovered through licensing fees (if this long-term strategy is adopted in Florida).

Where/Who?

Opportunities for leveraging existing resources and projected financing schedules: A natural opportunity for the state to adopt and implement and test the efficacy of this recommendation in Florida would be to partner with or provide resources to support Gainesville Loves Mountains, the University of Florida (Conservation Clinic in the Levin College of Law), the City of Gainesville and GRU with the aforementioned ECO initiative. These partnerships and/or resources (e.g., the "one-stop shop" Recommendation) would be used to revise (where necessary for multifamily property owners/buildings), refine, and pilot test provisions as outlined in their draft ECO time-of-transaction strategy.

Florida could also pilot this type of program anywhere PACE financing mechanisms are in place. For example, the PACE program in St. Lucie County finances commercial projects related to energy efficiency, renewable energy, wind-hazard mitigation, and water conservation. PACE assessments are available for terms of 5, 10, 15, and 20 years, and the maximum amount of funding available for a project is determined by the net equity in the property.[207]

Other promising time-of-transaction program opportunities relate to housing assistance and subsidy certification programs, renewal cycles and expirations. Housing experts from the University of Florida, Shimberg Center for Housing Studies emphasized the importance of designing state multifamily efficiency programs to capitalize on these key intervention time periods. The first such opportunity is immediate and is to develop and apply efficiency performance thresholds upon renewal of HUD Section 8 program subsidies. Certification of eligibility for these assistance programs occurs in 5-year cycles, and each year there are properties where certification expires or property owners can opt out of the contracts (in which case the property might move to market-rate). Upon each renewal of a contract with HUD, the properties must undergo an inspection. These inspections present natural opportunities to systematically gather performance data on targeted multifamily properties—those that are identified as good candidates for retrofits (Recommendation #5)—and test time-of-transaction program designs.

The second time-of-transaction opportunity on the horizon and with the potential to capture deep savings in Florida's assisted housing is the expiration of Low-Income Housing Tax Credit (LIHTC) property certifications. The Florida Housing Finance Corporation (FHFC) administers these assistance programs, and they have 30-year use restrictions. Beginning in 2019 and ramping up through 2025, multifamily developments receiving LIHTC assistance that were built in the late 1980s and early 1990s may begin to leave the assisted housing inventory. The state should ensure that efficiency retrofit provisions and incentives are in place when these application/recertification cycles occur. These opportunities underscore the importance of piloting such time-of-transaction or point-of sale strategies.

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[207] Doug Coward, "SLC launches new commercial retrofit program," TCPALM, August 18, 2014, http://www.tcpalm.com/ugc/st-lucie-county-ugc/slc-launches-new-commercial-retrofit-program_12295485

Integration/synergies: A time-of-transaction or point-of-sale pilot program and demonstration project will be most effective if coupled with a one-stop shop for multifamily efficiency resources (Recommendation #4) benchmarking and targeting programs (Recommendation #5), installing shallow retrofits during audits (Recommendation #7), and/or providing support for innovative financing mechanisms (Recommendation #8).

Recommendation #3: Pilot test market-driven tools to reveal rental housing costs and property efficiency performance measures.

What?

Letting the market determine the value of energy efficiency at the time of decision making is the goal. Through good information the efficiency retrofits may be demanded and accomplished, overcoming the split-incentive barrier. The state should provide support for development and pilot testing of new market-driven tools that reveal and add value to housing cost data (rents and utilities). The goal is to provide valuable, market-based information for owner and renter decision-making and to allow private entities to innovate using this information to offer efficiency program solutions.

Why?

The most meaningful performance metric for prospective renters' decision-making is out-of-pocket expenses (rather than kWh of electricity or gallons of water consumed). The proposed recommendation would enable efficiency features of rental properties to be promoted as marketable property values/amenities. Furthermore, a market-driven program would allow the market to value the cost of efficiency in decision making and would potentially be less costly than any government-sponsored program. For market-rate rental properties, these strategies could create new spaces for and advance efficiency retrofit activities of Energy Service Companies (ESCOs).

How?

To spur landlords to take action, a requirement could be imposed with a sunset provision in legislation directing them to advertise the monthly rental rate and average cost of utilities. It would apply to any rental property/landlord where the cost of the unit is promoted or disclosed. A successful market-driven program would require mandates for disclosure and benchmarking of housing costs.

Specific strategies for implementation: To provide privacy protections and overcome large differences due to occupant behavior, performance data should be aggregated and averaged across individual properties' buildings and units: at a minimum, this information would include average utility bill (ideally, electric, natural gas where applicable and water) and average base rents. For example, the advertised utility rate for a two-bedroom unit in a complex with twenty two-bedroom units might be the median of those units' utility bills over the past three years adjusted for any non-occupancy periods. One such approach would be to take utility data aggregated for the entire building and use the average for individual units. This data aggregating methodology is currently under review and being considered for implementation by the Maryland Public Service Commission.[208]

While data provided to the general public would be aggregate, unit-level consumption data should be available to property owners, program administrators and third-party consultants or contractors so that they may be used to identify the most promising unit-level efficiency investment opportunities. Market tools

[208] Case Nos. 9153 through 9157

should be supported by adoption of energy disclosure laws for rental properties and green lease provisions that authorize property owner access to unit-level utility consumption data for the purposes of aggregation and compliance with disclosure laws.

A similar program that could serve as a model for this program recommendation is the Alachua County "How Low Can You Go?" water challenge: a conservation initiative that used tracking of utility (GRU) water consumption data to stimulate competition among residents to reduce their use and cut their water bills. Prizes are awarded based on performance: going to those with the greatest percent reduction in water use.[209] According to an interview with an expert familiar with this program and its outcomes, it demonstrates the potential to change behavior—and save resources—by communicating utility data in strategic and creative ways.[210] Another market-based program that could be adapted or used as a model for this program recommendation is the popular Opower program, a service that provides customized "Home Energy Reports" to utility customers to raise awareness of their consumption and promote behavior change. This program has been adopted by dozens of utilities, including Gainesville Regional Utilities (GRU). The GRU pilot "Home Energy Reports" project ran for three years, with reports delivered to approximately 25,000 residential customers living in single-family homes, condominiums, apartments and duplexes. A University of Florida program impact analysis measured average energy savings of 1.0% in the first year of this pilot project[211] and GRU reported that the program saved its customers over $1.8 million on their utility bills.[212]

Who?

This type of program could be launched rapidly in regions where property- and unit-level data are already being disclosed through community-based initiatives. For example, it might be piloted in Gainesville, which has a significant population of seasonal and transient renter households and is equipped with Tools for Tenants—a web tool for renters to view and compare the average rents and utilities across apartment complexes,[213] Gainesville-Green—a similar website that displays historical energy and water consumption data for single-family homes,[214] and the Gainesville Open Data Portal that provides users with direct access to government data sets including utility consumption.[215] Orlando is another potential region for piloting this type of market-based program. The city has an emerging Data Access Platform[216] that is part of the City Energy Project[217] and program managers are building strong stakeholder networks with an interest in improving the energy efficiency of multifamily buildings.

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209 See "How Low Can You Go? League of Women Voters of Alachua County/Gainesville Water Challenge" at http://lwv-alachua.org/pdfs/LWV_Water_Challenge_Official_Rules.pdf

210 Stakeholder interview with a water resources economist at the University of Florida who studies water pricing, rate design and conservation programs.

211 Jones, Taylor and Kipp. University of Florida Program for Resource Efficient Communities. "GRU Residential Energy Efficiency DSM Program Evaluations: 2010 Program Year." Technical report prepared for GRU. February 20, 2012.

212 The Gainesville Sun. "We help customers save on energy bills." Letter to the Editor on January 6, 2013. http://www.gainesville.com/article/20130106/OPINION02/130109811. Accessed December 31, 2014.

213 See http://www.toolsfortenants.com/about. Accessed December 31, 2014.

214 See http://gainesville-green.com/. Accessed December 31, 2014.

215 See "dataGNV: Gainesville's open data portal; an initiative towards open government and transparency." Accessible at https://data.cityofgainesville.org/

216 City of Orlando, "Orlando's City Energy Project Plan (draft)", provided by Chris Castro, Community Energy Program Manager, Senior Energy Adviser, Institute of Market Transformation, City Energy Project.

217 This is a national initiative of the Natural Resources Defense Council (NRDC) and the Institute for Market Transformation (IMT) to reduce energy waste in large commercial buildings (including multifamily): http://www.cityenergyproject.org/. Orlando is one of ten cities participating in the initiative http://www.cityoforlando.net/greenworks/cep/

Short-term needs: An initial step in program development could include market research (e.g., a focus group with prospective renters and/or systematic user analytics) to test the effectiveness of similar data disclosure tools, such as Tools for Tenants.

Long-term needs**:** Legislative action would be needed with administrative authority granted to the Florida Public Service Commission to require disclosure of multifamily utility billing data for the sole purpose of advertising average utility rates. Legislation would also need to include a requirement that rental properties be advertised with the combined rate of utilities plus base rents with the breakout available as well. As noted above, for privacy purposes this disclosure could be aggregated by the utility or state-designated third party. An option would be to require any landlord/owner/manager of Florida complexes of 20 units or more to require the advertisement of the rate with the utility bill (a three-part rate- base, electric and gas, and total). If following a mandatory path for implementation, current communication tools that are used to advertise rental properties and rates would have to be modified, incorporating features such as those used by Tools for Tenants, referenced above. Enforcement mechanisms and incentives/penalties for non-compliance should also be integrated as long-term measures if the program is mandatory.

Recommendation #4: Create a one-stop shop for multifamily efficiency retrofit resources, tools, programs, and partners.

What?

The state could establish a multifamily efficiency "one-stop-shop" to house retrofit opportunity resources and tools and connect and coordinate programs and partners.

Why?

The goal is to improve efficiency and effectiveness of any multifamily efficiency initiative by removing barriers of access to information and resources for motivated program participants. A challenge for property owners or tenants who want to embark on efficiency retrofit projects in multifamily buildings is lining up the audits, contractors, financing, and necessary oversight to implement the project. A best practice is to streamline the delivery of services through a single entity (one-stop shop) that can arrange the audit, perform or facilitate upgrades and provide third-party measurement and verification of savings. Much like a building requires a general contractor who calls subcontractors, a building owner would rely on one entity that can coordinate the various phases of the project and direct project managers to the most current and relevant incentives and resources.

> *"Involving owners, property managers, real estate brokers, lenders, local banks and contractors early in the project planning phase is critical to the success of efficiency retrofit projects.*

How?

A successful program will have the following components and features:

- An overall program design strategy to improve the coordination, success and cost-effectiveness of any multifamily retrofit project;
- A program designed to market the non-energy benefits of efficiency retrofits to property owners and provide access to financial incentives for participation (e.g., utility rebates) to address the split incentive problem and encourage property owners to make efficiency investments even if they do not benefit directly from lower utility bills;

- A proven method of efficient performance auditing and tailored, cost-effective upgrade recommendations;
- Central housing and unification of data and tools that can reduce the time, cost and inconveniences to property owners and tenants during project implementation;
- Post-retrofit independent measurement and verification (i.e., post-retrofit inspections and performance assessments) that will lend credibility to the project and generate data useful for improving the effectiveness of future projects;
- Costs, savings information and other feedback to the entity charged with program design so that improvements can be made.

Implementation of this program recommendation could be modeled after Energy Savers, an often-cited example of a successful one-stop shop program in Illinois.[218] The program provides free energy audits for multifamily residential buildings, assists building owners in applying for incentives, helps them secure loans, and provides assistance in obtaining contractor bids, monitoring construction, monitoring a building's utility performance and conducting inspections. A cost-benefit analysis of 57 properties in the Chicago area showed a reduction of 26% in natural gas consumption (savings occurred for water and electricity as well, but were not included in the analysis).[219]

Who?

A state entity could fill the roles necessary to serve as a one-stop-shop for multifamily efficiency, building on and expanding existing capacities, projects and tools such as the FDACS Florida Energy Clearinghouse, My Florida Home Energy and My Florida Energy Projects. Alternatively, a third-party contractor could fill this role and provide one-stop shop services. In this case, one immediate action item for which the state could provide funding and administrative support would be a needs assessment that includes a comprehensive inventory of existing educational materials and resources (in Florida and in other states, regions or nationally) that can be referenced directly or adapted for Florida's needs. For example, *Prezcat* is an online catalog of resources for stakeholders interested in promoting efficiency in affordable housing—designed to connect housing developers, finance agencies and advocates.[220] National and local resources could be mined and key information communicated meaningfully by one-stop-shop staff who are most familiar with the unique opportunities and constraints faced by Florida property owners and project administrators.

Recommendation #5: Implement a pilot program or demonstration project that targets efficiency retrofit measures to specific multifamily market segments.

What?

Develop a pilot program or demonstration project that applies benchmarking tools to target specific multifamily market segments with efficiency retrofit incentives. The objective is to target multifamily

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[218] "Chicago Area Energy Savers Program", American Council for an Energy-Efficient Economy, at http://www.aceee.org/sector/local-policy/case-studies/chicago-area-energy-savers-program.

[219] Jon Braman, Steven Kolberg, and Jeff Perlman. June 2014. Energy and Water Savings in Multifamily Retrofits, Stewards of Affordable Housing for the Future, 26, http://www.sahfnet.org/multifamilyretrofitreport_2_1287596736.pdf.

[220] http://www.prezcat.org/about-preservation-catalog. Accessed December 31, 2014.

properties, owners and/or tenants based on savings potential (using benchmarking tools) and with the goal of improving the overall success and cost-effectiveness of retrofits.

Why?

The ultimate goal of a near-term pilot program/demonstration project is to strategically capture cost-effective and scalable savings by applying benchmarking and targeting best practices. The challenge is that most benchmarking tools for multifamily efficiency performance—other than those developed independently by utilities or third-party contractors for utility use—are very new (released in 2014) following the wave of activity around and interest in multifamily energy and water efficiency. Furthermore, we are not aware of any Florida programs or projects that have combined benchmarking and targeting best practices to improve efficiency program marketing and address the split incentive. While at least one utility in Florida (OUC) has expressed interest in testing targeting strategies[221], none have yet piloted such a program to market retrofit and efficiency incentives measures to multifamily owners.

There is, however, empirical data and ex-post analysis supporting the use of targeting. The findings of a recent study examining the impact of retrofit energy-efficiency upgrades to four apartment complexes in Orlando suggests a "substantial variability in savings across complexes despite similar retrofit packages."[222] This variability implies that targeting buildings with poor baseline performance can potentially increase savings (and improve the cost effectiveness) of energy-efficient retrofit programs. Another study[223], this time of Gainesville residencies, examined the cost effectiveness of a program aimed at replacing low-efficiency AC units and found substantial energy savings. Another study[224] providing information about targeting examined the cost effectiveness of a rebate program for high efficiency toilets in North Carolina residential units. The study found that while the rebates were not cost effective in the way in which they were implemented, more direct targeting of high efficiency toilet replacement incentives by utilities can be quite cost effective. It is important to note that these studies could only take place because data were available for researchers to assess the impact of the efficiency measures.

Incentives from the state could help move these types of initiatives forward and pilot programs are necessary to verify efficacy of program designs. To develop and implement successful and cost-effective programs, we need a better understanding of which tools are most effective and which program design strategies are the most important. A program that integrates these tools and techniques with incentives to property owners for participation would not only allow third parties to test the efficacy of multifamily benchmarking and targeting, but would also generate local and current information to inform the design of other state or local multifamily efficiency and incentive programs (such as utility rebates for multifamily). When coupled with marketing strategies to reach owners of targeted properties with community-based social marketing strategies and/or incentives for retrofit program participation, such a program could lead to higher participation rates and persistence of savings.

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[221] Stakeholder interview with OUC representative and personal communication with PREC faculty outside the scope of this study.

[222] Taylor, Nicholas W., Jennison K. Searcy, and Pierce H. Jones. 2014. Multifamily Energy-Efficiency Retrofit Programs: a Florida Case Study. PREC working paper, page 24.

[223] Boampong, Richard. 2014. Evaluating the Energy Savings Effect of a Utility Demand-Side Management Program using a Difference-in-Difference Coarsened Exact Matching Approach. PURC working paper.

[224] Bennear, Lori, Jonathan Lee, and Laura Taylor. 2013. Municipal rebate programs for environmental retrofits: an evaluation of additionality and cost-effectiveness. Journal of Policy Analysis and Management, Vol. 32, No. 2, 350–372.

Near-term strategies:

How?
Benchmarking tools should use and evaluate historical consumption data to target energy and water retrofit measures based on performance (i.e., energy or water efficiency) and/or other complementary policy and program priorities (e.g., to reach elderly or low-income populations). Performance-based targeting would, for example, use benchmarking tools to identify prospective candidates where savings potential is the greatest and payback periods are expected to be short, then market retrofits to these property owners. Need-based targeting might first screen potential retrofit candidates against housing type, estimates of relative housing cost burdens of tenant households and/or demographic or assistance program participation and then apply performance-based benchmarking to target retrofit opportunities within this smaller pool of potential candidates. Contingent upon the availability and resolution of consumption data, benchmarking and targeting can be applied across multifamily owner/landlord portfolios, multifamily developments, individual buildings and individual apartments/units. Low-interest retrofit loans or other financial incentives should be directed to the property owners most likely to benefit. These near-term strategies relate to and would be strengthened by adoption of Recommendation #3—market-based tools to reveal housing cost burdens, Recommendation #4—one-stop shop, and Recommendation #8—innovative financing programs.

When selecting and advertising qualified retrofit measures, emphasize those that are low-cost and have short payback periods (e.g. efficient bulbs, duct sealing, low flow aerators, weatherization; attic insulation; ENERGY STAR refrigerators and washing machines; programmable thermostats; high efficiency toilets). Another important strategy to address the split-incentive problem when marketing targeted retrofit opportunities might be to include incentives or rebates for common area upgrades—as either a "bonus" for unit-level improvements or as the "hook" to bring owners to the table to consider retrofits. Qualified measures might include replacement of inefficient exterior lighting fixtures and installation of occupancy sensors in laundry rooms, hallways and interior recreational spaces. For large multifamily properties, lighting is often considered the "low-hanging fruit" where owners can capture a rapid and direct return on their investments.

Where/Who?
Depending on legislative and administrative goals and priorities, the recommended near-term program could target one or more prospective multifamily market segments, such as: subsidized/assisted properties; affordable housing; older, inefficient buildings; geographic regions/utility service areas with high densities or concentrations of multifamily rental properties; master-metered buildings; and/or owners with large portfolios of multifamily properties. Benchmarking as a best practice would still apply regardless of the target market for efficiency retrofits.

To target based on efficiency performance, ready access to utility data is critical. While almost any utility could provide these data to support a targeting pilot program or project, the JEA service area, St. Johns River Water Management District (SJRWMD), Northeast Florida geographic region and/or the OUC service area, Orange County, Central Florida region might be ideal locations to implement this recommendation. JEA and OUC have both been leaders in providing third-party access to complete energy and water consumption data as a strategy for identifying efficiency program opportunities and they are the state's only municipal utilities subject to provisions of the Florida Energy Efficiency and Conservation Act. These regions also benefit from local tools like the Florida Automated Water Conservation Evaluation Tool (FAWCET)[225] and rich

[225] Details about FAWCET provided through stakeholder interview with SJRWMD staff and "Florida Automated Water Conservation Estimation Tool Overview" accessible at http://fwrj.com/techarticles/0414%20tech%202.pdf

datasets on water utility rate structures, both of which have been developed by and are available through SJRWMD. Such tools and data could allow for rapid benchmarking assessments and strategic targeting to critical water shortage areas and those with the lowest water rates/highest use, for example.

Because both JEA and OUC provide energy and water services, Recommendation #7 (combined energy and water shallow retrofits) could also be readily tested in concert with a benchmarking and targeting program that also provides access to existing incentive/rebate programs such as ENERGY STAR for Multifamily and WaterSense. A property owner who participated in OUC's Multifamily Custom Incentive Program has also participated in the Florida Water Star program, installing water efficiency and conservation retrofits at several other properties.[226]

To target based on renter household need, an option would be to benchmark performance across subsets of assisted multifamily properties and/or by using census block and/or housing authority program data to market programs to owners of properties with the highest estimated or actual housing cost burdens. For this pathway, access to utility consumption data is a necessary but insufficient condition for effective program implementation. Household incomes must also be included in the targeting and benchmarking effort. This implementation strategy should leverage the housing researcher networks, rental market and assisted housing reports, and statewide datasets available through the Shimberg Center for Housing Studies at the University of Florida. These resources provide a wealth of data to guide program priorities for reaching the most cost-burdened renter households (or other demographic or socio-economic targets) in multifamily dwellings.

Long-term strategies:

How?

This program recommendation will be most successful over a long-term horizon if data disclosure provisions are in place and data are transparent and accessible (consistent with Recommendation #3). Open and accessible consumption data can be used to guide program priorities, financial investments and direct market efforts to the most promising customer markets. One long-term strategy to provide these assurances would be to mandate benchmarking of rental housing performance and efficiency (i.e., provide measures of relative consumption/performance). Streamlining the collection of these data would entail coordination with the Department of Revenue to ensure clear reporting requirements for property appraisers who collect parcel and building data at a local level and report to the state.

Another valuable long-term strategy to support this program recommendation is to centralize, coordinate and streamline flows of Florida energy and water data and efficiency program information. The goal is to coordinate flows of energy- and water-efficiency data through state departments/agencies currently engaged in and/or providing oversight to existing efficiency programs. This long-term recommendation also complements and would create synergies with Recommendation #4 to create a one-stop shop for multifamily efficiency programs and projects.

Who?

FDACS Florida Energy Clearinghouse is an existing resource to house these data and serve as a central portal for end users. Note the existing partners, programs and tools provided by FDACS Florida Energy Clearinghouse—e.g., My Florida Home Energy—that could be quickly replicated for multifamily end users. Other state agencies/departments with a potential role and interests in this type of data disclosure and coordination effort include: the Department of Economic Opportunity (which houses Weatherization

[226] Stakeholder interview with AGPM, LLC representative.

Assistance Program and LIHEAP program data); the Public Service Commission (which houses utility efficiency and conservation/demand-side management program data); the Department of Environmental Protection and regional Water Management Districts (which houses water quality and water supply/consumptive use permitting data); and the Department of Revenue (which houses property appraiser, building characteristics and unit-level data).

Recommendation #6: Develop and deliver new education and awareness programs tailored to the needs of multifamily property owners, managers, maintenance staff, and tenants.

What?

Develop and pilot test new education and awareness programs designed specifically to reach multifamily property owners, property managers, maintenance staff, and tenants with information about the benefits of energy and water efficiency investments.

Why?

The short-term goal is to improve awareness and understanding of the range of benefits (direct and indirect) from investments in the energy and water efficiency of Florida's multifamily buildings. Except in unique circumstances where owners are mission-driven with social and/or environmental goals embedded in their business models, they may not be exposed to or pursue this type of information on their own. Community-based social marketing tools can be used to develop effective education programs for multifamily owners, property managers, and their maintenance staff and tenants. The long-term goal is to change behavior so that more property owners seriously consider investments in energy efficiency, even in the absence of mandatory incentives to make improvements, and implement efficiency retrofit programs.

How?

The state could leverage existing resources to develop and provide outreach and training/continuing education programs (e.g., through Apartment Association of Greater Orlando, City Energy Initiative) specific to multifamily energy and water efficiency. Program content should be tailored to communicate the short-term *and* long-term benefits of efficiency investments. It should also emphasize management strategies for ensuring effective operations and maintenance of installed measures.

Who?

FDACS, through Florida Energy Systems Consortium (FESC) partners and networks could provide administrative support and/or funding to develop and pilot test new multifamily education programs. Through FDACS Florida Energy Clearinghouse, FDACS and FESC partners can also act to facilitate the flow of information about existing and new programs from cooperating utilities and other efficiency advocacy and education groups to decision makers and end users. This role would be complemented and strengthened through adoption of the long-term strategies in support of Recommendation #5: centralizing, coordinating and streamline flows of Florida energy and water data and efficiency program information.

Program design considerations: Important target audiences for whom education program content should be tailored and to whom programs should be marketed include:

- multifamily *property owners/landlords*, who might be recruited for participation through local government growth management and permitting departments; real-estate investment trusts (REITs), public housing authorities, community development corporations, community redevelopment agencies; and other community-based or trade associations;

- *property managers*, who can be reached through Community Association Managers training and continuing education to maintain licensure;
- *property maintenance staff,* who can be reached through apartment associations, property owners and managers, and indirectly through tenant education;
- *HVAC, plumbing and landscape service contractors, engineers, architects and landscape architects*, who can be reached through DBPR licensure databases and targeted based on continuing education credit cycles; and
- *consumers/tenants,* who can be engaged through community-based programs, affordable housing initiatives, local housing authorities and others who administer low-income programs, utility audits, rebates, demand-side management program resources and informational flyers, and real-estate/marketing tools.

Short-term strategies: Where target audiences are not required to attend education programs for continuing education credits or as a contingency of license renewals, marketing the potential direct benefits to property owners (e.g., from common-area retrofits or improvements to master-metered communities) could be a strategy to engage property owners. To reach maintenance staff and contractors, funding should be made available to provide free training workshops. Content for such programs might include proper sizing, installation and maintenance schedules for HVAC systems to improve energy and water efficiency. Another best practice for education and awareness programs is to coordinate information about energy and water programs, cost-effective retrofit measures and available incentives and financing: emphasize the value of "just adding water/energy" to decision-making and message information in tailored ways to different end users.

Long-term strategies: Require continuing education credits for energy and water efficiency for property managers and maintenance staff licensing. To effectively develop educational programs and market efficiency retrofit programs to prospective participants/property owners, more research is needed to understand property owner motivation for considering and participating in such programs. To explore these motivations further, an education and training program could be developed specifically for property owners and community association managers. As part of this education program development, it would be helpful for an independent party to conduct focus groups and/or in-depth interviews with property owners who have expressed interest in and/or participated in existing efficiency incentive programs. This long-term strategy would build on and complement current multifamily efficiency research being conducted by the University of Florida toward a grant from the John D. and Catherine T. MacArthur Foundation.[227] Part of the three-year project—"Multifamily Energy Consumption, Tenant Stability, and Retrofit Effectiveness"—involves in-depth interviews with property owners who participated in the OUC Custom Incentive Program and the St. Johns Housing Partnership Weatherization Assistance Program retrofits.

Currently, there is no statewide requirement that landlords be licensed. Licensing is determined at the local level in Florida. A long-term recommendation that would ultimately improve the reach and success of continuing education programs on multifamily efficiency would be to require licensing of all landlords who own and rent properties (for example, with a threshold for compliance of owning and renting 20 or more units). This strategy would also complement the "enforce existing codes" and "time-of-transaction"

[227] MacArthur Foundation, How Housing Matters, "MacArthur Awards $2.8 Million to Support Research on How Housing Matters." See University of Florida Shimberg Center for Housing Studies and Program for Resource Efficient Communities. October 23, 2013. http://www.macfound.org/press/press-releases/macarthur-awards-28-million-support-research-how-housing-matters/#shimberg

recommendations (#1 and #2) as it would provide a regular window of opportunity (license renewal) to verify compliance and trigger retrofit requirements where and when needed.

Recommendation #7: Provide funding for pilot programs or demonstration projects that install shallow retrofits packages during walk-through audits of multifamily properties.

What?

Install shallow water and energy retrofit packages during walk-through audits of multifamily properties. These shallow retrofit packages might look similar to the packages used to model savings potential for this study or they might be tailored by utility conservation staff and/or qualified energy raters. All measures included should have short payback periods (less than five years). It is common practice for utilities to install a single low-cost measure during audits: for example, energy audits performed by Florida Public Utilities typically include the installation of ten high-efficiency light bulbs. This recommendation would expand the scope of this practice to include additional energy efficiency measures and to also couple them with low-cost water efficiency measures.

How?

This could be accomplished by directing funding to an interested utility or third party who would be willing to pilot the program. Funding would be used to cover the additional program costs: administration, staff and energy and water conservation measures, measurement and verification of program savings, etc.

<u>Long-term strategy</u>: modify FEECA provisions to make this a requirement for all utilities subject to FEECA.

Recommendation #8: Develop and pilot test an on-bill financing program and/or provide funding to couple utility rebates with access to low-interest revolving loan funds.

What?

Offer a program/programs to provide enhanced financing incentives (additional funding and/or rebates) to spur interest in and access to low-interest revolving loan funds.

Why?

Interest and participation in existing multifamily retrofit incentive programs could be improved if the state were to offer coordinated multifamily lending activities. The intent of this program is to help ensure the success of existing revolving loan fund programs in which the state already has invested financial and staff resources. The first measure of "success" is getting these dedicated dollars into the hands of property owners for financing cost-effective energy and water retrofits. Easy access to financing should make project investments more likely, all things equal. Ultimately, the retrofit projects themselves will generate better information about the returns on such investments and the non-energy benefits that can accrue to investors, owners, and tenants. This information, in turn, can be used to spur additional market activity around multifamily efficiency.

Another compelling reason to offer an on-bill financing or repayment program is because investor-owned utilities subject to the Florida Energy Efficiency and Conservation Act (FEECA) no longer offer direct financing for investments in efficiency measures using electricity. So if financing is part of a multifamily retrofit program, it may need to be provided by another source, such as community-based organizations, perhaps in partnership with FEECA-covered electric utilities. An exception is if a FEECA-covered investor-owned utility provides natural gas and electric service, such as Florida Public Utilities. Customers served by that utility are still allowed to make payments on their bills for natural gas water heaters since natural gas utilities are still subject to FEECA requirements but not to the goal-setting process and associated cost-effectiveness test provisions.

How?

Low-cost financing should be arranged for projects that an audit has determined to be cost-effective and where feasible the best practice of on-bill financing should be employed. For example, Florida Public Utilities provides on-bill financing for natural gas water heaters to overcome the barrier associated with large upfront costs to the consumer. Energy audits of multifamily properties should include specific recommendations for owners as well as information about access to financing options. A near-term pilot program for on-bill financing could be combined with revised provisions and offered as an additional incentive for participation in two existing Florida programs. First, on-bill financing could be piloted as part of the Florida Housing Finance Corporation's Multifamily Energy Retrofit Program (MERP) to streamline the program's application, selection and repayment processes, which already depend on reliable access to utility data. Second, on-bill financing could be piloted as part of the Florida Energy Efficiency Loan (FEEL) revolving loan fund program if eligibility for the program is extended to multifamily property owners.

Long-term strategy: The success of near-term pilot programs for on-bill financing ultimately depends on ready access to utility data, particularly for projects that (as a contingency of program funding and otherwise) need those data to demonstrate eligibility, project loan repayment schedules and/or must measure and verification savings. The goal is to shift responsibility for utility data provision from the program applicant or property owner to the partner utility.

Implementation details: This long-term strategy would require legislative action to require data provision by utilities when a property owner in their service area is selected to participate in an efficiency retrofit project supported with public funding (through direct program financing and/or on-bill repayment mechanisms). As a contingency of program participation by the property owner, Florida utilities would be mandated to provide unit-level (for individually-metered buildings) and building-level (for master-metered buildings) pre- and post-retrofit consumption data for the owner's property or property and a sample of comparable non-participant multifamily properties in their utility service area. The project manager and/or entity responsible under program guidelines for measuring and reporting program impacts would also be responsible for specifying the criteria for selection of comparable properties. Implementation of this recommendation would remove the potential barrier of property owner access to utility data for program needs, reduce administrative cost to property owners and program managers, minimize the burden of data provision on partner utilities (by limiting the sample of properties for which consumption data must be provided), and ensure access to the data necessary to generate valid measures of program impact (energy and water savings, etc.) Ultimately, implementation of this recommendation should improve the overall cost-effectiveness of any retrofit project, particularly if combined with targeting strategies to identify the best candidates for retrofit activities.

Where/Who?/Integration: Several recent and emerging efficiency finance projects and multifamily retrofit programs represent natural opportunities to launch and test on-bill financing programs and integrate them with other program recommendations. These include: coupling on-bill financing with MERP revolving loan funds, providing administrative support and/or funds to expand FEEL eligibility to multifamily property owners, marketing the program incentives to target properties (Recommendation #5), and considering an on-bill financing option. Another strategy would be to test on-bill financing with a partner municipal utility.

OUC might be a good candidate because of its experience with piloting the Multifamily Custom Incentive Program and interest in offering a demand-side management program informed by this program. The state could provide administrative support and/or funding to replicate the Multifamily Custom Incentive Program, modifying provisions and incentives based on lessons learned and capturing deeper savings through targeted program marketing and retrofit measures (this also complements Recommendation # 5).

7. Further Resources

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7.2 Study team contact information

Public Utility Research Center (PURC)
University of Florida
Warrington College of Business Administration
Gainesville, Florida

Dr. Lynne Holt
Policy Analyst | 352.392.8784
lynne.holt@warrington.ufl.edu

Dr. Mark Jamison
PURC Director | 352.392.2929
jamisoma@ufl.edu

Dr. Theodore Kury
Director of Energy Studies | 352.392.7842
ted.kury@warrington.ufl.edu

Dr. Michelle Phillips
Junior Economist | 352.392.0060
michelle.phillips@warrington.ufl.edu

Program for Resource Efficient Communities (PREC)
University of Florida
Institute of Food and Agricultural Sciences
Gainesville, Florida

Lynn Jarrett
Water Resources Engineer | 352.273.0246
ljarrett@ufl.edu

Dr. Pierce Jones
PREC Director | 352.392.8074
piercejones@ufl.edu

Craig Miller
PREC Associate | 352.392.1513
craigmil@ufl.edu

Jennison Kipp Searcy
Resource Economist | 352.273.0245
mjkipp@ufl.edu

Nicholas Taylor
Housing Systems Analyst | 352.392.3121
nwtaylor@ufl.edu

Florida Solar Energy Center (FSEC)
University of Central Florida
Buildings Research
Cocoa, Florida

David Chasar
Senior Research Engineer | 321.638.1453
dchasar@fsec.ucf.edu

Jeremy Nelson
Senior Research Technician | 321.638.1016
jnelson@fsec.ucf.edu

Jeffrey Sonne
Senior Research Engineer | 321.638.1406
jeff@fsec.ucf.edu

Robin Vieira
FSEC Director | 321.638.1404
robin@fsec.ucf.edu

UF UNIVERSITY of FLORIDA
IFAS EXTENSION
Program for Resource Efficient Communities

UF Public Utility Research Center
Warrington College of Business Administration
UNIVERSITY of FLORIDA

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